Mia Sinaga' Developed of Bioentrepreneur Based Student Worksheets for Food Biotechnology Material on Entrepreneurial Interest and Student Creativity

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Abstract. Entrepreneurial skills are instilled to overcome future labor market challenges, in line with government directives. This aims to change the mindset of the younger generation from job seekers to job creators. Application book based worksheet Biotechnology on eye studying Bioentrepreneur aim For increase interest And creativity student entrepreneurship . This development research uses the ADDIE development model which consists of five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. Validation from experts, such as: validation of subject matter experts, validation of learning media experts, and validation of learning design experts. Apart from that, feasibility and practicality questionnaires were also conducted by teaching lecturers, small groups and students using Biotechnology-based worksheet books. Results evaluation creativity with N-Gain value of 80% with category interpretation effective . Whereas mark effectiveness For interest businessman with N-Gain value 54%, with interpretation not enough effective . Reviewed from questionnaire evaluation student with LKM, determined mark appropriateness amounted to 88.7 % , and the practicality value was 85%..

Keywords: Bioentrepreneurship; Biotechnology; Creativity; Entrepreneurial interests of students.

1 Introduction

Indonesia's strong desire become a developed country by 2085, driven by a commitment to economic independenc, underscores the need for a strong and entrepreneurial workforce. [1] . Despite having this vision, Indonesia lags behind neighboring countries in terms of entrepreneurship, this can be seen from the entrepreneurship rate of only 3.18%, in contrast to Singapore, Malaysia and other countries. [2] . Additionally, the country is grappling with a volatile unemployment landscape, with recent graduates facing challenges in finding work or running entrepreneurial ventures. In the midst of these challenges, higher education institutions play an important role in finding solutions. [3]

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Entrepreneurship education is the foundation in transforming Indonesia's young generation from job seekers to opportunity creators [4] . In the Industry 4.0 era which is characterized by technological convergence, the combination of technology and entrepreneurship has significant potential [5] . It is in this dynamic context that the integration of entrepreneurship education into the academic curriculum emerges as a means of overcoming the problem of unemployment and fostering an entrepreneurial ethos. [6] .

Existing research highlights the gap between entrepreneurial aspirations in Indonesia and its current state, necessitating a comprehensive approach to entrepreneurship education [7] . While recognizing this gap, this research explores the integration of Bioentrepreneurship into the academic setting, specifically in the domain of Food Conventional Biotechnology offered by the UNIMED Department of Biology. This exploration of new approaches aims to bridge the gap between traditional biology education and the demands of the evolving job market.

This research seeks to assess the effectiveness, feasibility and practicality of Student Workbooks which are carefully created and equipped with Bioentrepreneurship principles. By focusing on the context of conventional food biotechnology, this research seeks to empower students to develop entrepreneurial interests while navigating the intricacies of their academic discipline. [8] . The benefits extend beyond the boundaries of the classroom, equipping students with the skills and mindset needed to develop into innovative entrepreneurs, thereby contributing to the transformation of the Indonesian economy [9] .

The results of this research have significance for academics, policy makers and industry stakeholders. The insights gained from this research can contribute to improving entrepreneurship education strategies in universities throughout Indonesia. In addition, the integration of bioentrepreneurship education can produce a new generation of graduates who are able to overcome contemporary challenges and drive economic progress.

This research introduces an innovative pedagogical approach by incorporating Bioentrepreneurship principles into conventional food biotechnology education. By doing this, it not only fosters a culture of innovation but also empowers students to bridge the gap between theoretical knowledge and practical application. This approach has the potential to form a generation that is forward-thinking, enterprising individuals and capable of encouraging the rise of Indonesian entrepreneurship on the global stage.

2. Research methods

The research method used is development research which uses a quantitative descriptive research approach [10] . This research aims to analyze the influence of student practicum LKM on entrepreneurial interest and creativity in the realm of Bioentrepreneurship. This research was conducted at Universitas Negeri Medan, especially in the Biology department. The ADDIE development model serves as a framework for the five stages of the research process: Analysis, Design, Development, Implementation, and Evaluation [11] .

The research design is in line with a quantitative descriptive approach, which involves collecting and analyzing numerical data to describe or illustrate the impact of student practical worksheets on entrepreneurial interest and creativity. [12] . Descriptive research methods are

very suitable for investigating current events or occurrences in meaningful numerical form [13] .

The data collection instrument process is seamlessly intertwined with the stages of the ADDIE development model, thereby increasing the precision and efficacy of educational materials. [14] . Along with the formation of the Bioentrepreneurship curriculum, a series of instruments aimed at facilitating comprehensive evaluation [15] First, the Characteristics Survey, a dynamic questionnaire, explores aspects of students' traits related to entrepreneurship. Exploring dimensions such as aspirations, previous experiences, risk-taking propensity, creativity, communication acumen, and networking abilities, the survey provides a holistic picture of each learner, serving as a basis for customizing the curriculum. [16] .

Furthermore, Validation Surveys emerged as an important tool utilized by experts. Systematic assessment, using a Likert scale, carefully examines the quality, accuracy, and overall design of learning materials [17] . The culmination of expert perspectives triggers an iterative refinement process, ensuring content alignment with pedagogical goals. In the midst of this iterative journey, the Design Validation stage becomes important. Drawing on insights from a diverse consortium of materials experts, media experts, and design experts, this evaluation measures the suitability of learning materials, media rationality, and design coherence. [18] .

Live Evaluation, a feedback channel used by Bioentrepreneurship course instructors, emerged as an invaluable checkpoint. Experienced instructors' views delve deeply into the areas of layout proficiency, presentation art, and educational impact. This input encapsulates the wisdom of the instructor's experience, guiding the adjustment process toward a harmonious blend of form and function. At the same time, the Pretest-Posttest Creativity Assessment reflects the growth trajectory of students' creativity. Through the lens of essay-based evaluation, it measures fluency of thinking, flexibility, originality, and elaboration [19] . The interaction between these dimensions not only informs pedagogical refinement but also highlights the cultivation of a fertile creative landscape in the mind of the learner. [20] . Finally, the Entrepreneurial Interest Questionnaire crystallizes the student's transformational journey. By measuring their entrepreneurial spirit before and after exploring material focused on Bioentrepreneurship, this provides an empirical picture of the impact of an in-depth curriculum. This instrument is proof of the potential of the curriculum in kindling and maintaining the fire of entrepreneurial spirit.

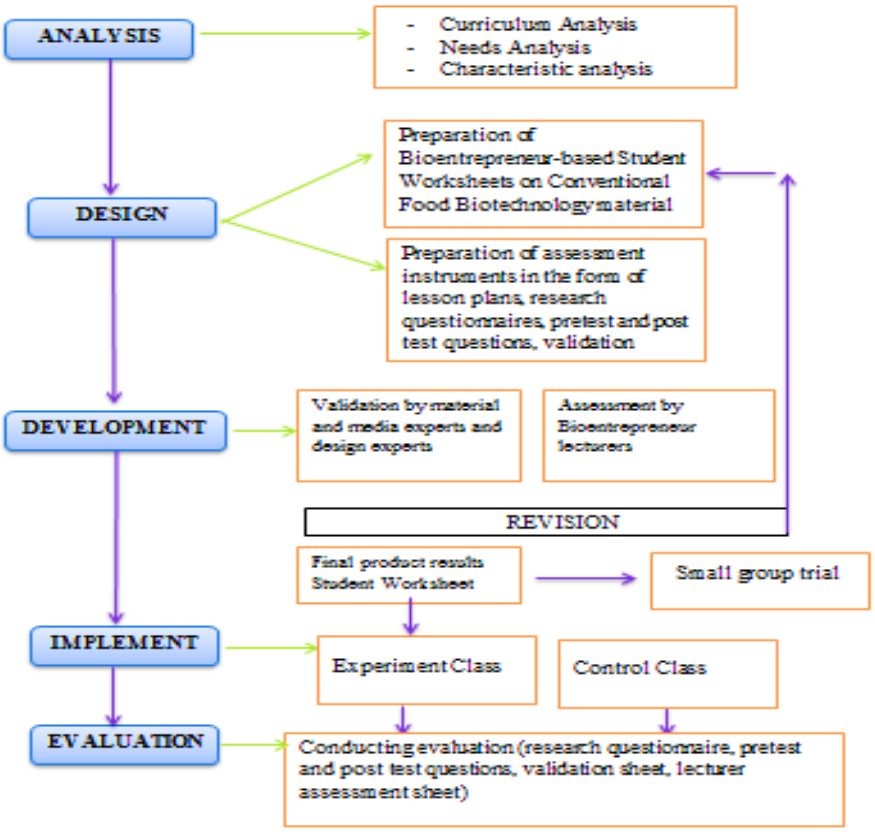


Figure 1. Research flow

In the fields of educational research and instructional design, a comprehensive scientific approach involves several interconnected steps aimed at evaluating and improving the quality of learning materials [21] . This process includes utilizing a variety of methodologies to ensure rigorous analysis and achievement of desired learning outcomes [22] .

One important aspect of this process is the careful organization and synthesis of data collected from the questionnaire questionnaires , field notes, and documentation [23] . These sources are researched to uncover recurring patterns and draw reasoned conclusions. Simultaneously, closed-ended questionnaire responses were collected from a spectrum of experts that included subject matter specialists, instructional design authorities, and media professionals [24] . These insights are utilized to draw guidelines for improving learning materials.

Additionally, the application of quantitative techniques plays an important role. Validation ratings are quantified, offering a measurable measure of expert judgment and culminating in the calculation of validity percentages for sub-variables [25] . This rigorous assessment helps in measuring the robustness and authenticity of the learning material. The evaluative framework extends to administering questionnaires to experts, designed to ensure alignment of the developed learning materials with predetermined appropriateness thresholds [26] . This

step is important to strengthen the alignment of the material with the desired educational goals.

In parallel, a feedback loop is created that engages instructors and students through carefully crafted questionnaires. This feedback serves as an important measure of the practicality of the learning material, which is assessed in predetermined categories [27] . This multifaceted feedback mechanism ensures that practicality is assessed from multiple angles. This process culminates in a comprehensive statistical analysis of pretest and posttest scores. Using sophisticated statistical tests, N-Gain scores are calculated to measure improvements in cognitive learning outcomes [28] . Additionally, a paired samples t-test was performed to examine the statistical significance of the impact of the independent variables [29] . This analytical approach provides a strong understanding of the efficacy of learning materials in promoting cognitive development.

In essence, the holistic scientific narrative outlined above encapsulates the careful orchestration of data collection, synthesis, validation, and analysis [30] . This multifaceted approach ensures comprehensive evaluation and improvement of learning materials, underscoring the importance of empirical rigor in the fields of educational research and instructional design.

3. Results and Discussion

3.1 Results

The Student Worksheet developed follows the ADDIE model and focuses on Bioentrepreneurship in Conventional Food Biotechnology. At the analysis stage, there are three main aspects studied: curriculum analysis, learning resource analysis, and student characteristics.

a. This study evaluated the curriculum, especially the Curriculum based on the Indonesian National Qualifications Framework (KKNI) which is integrated with the Independent Learning and Independent Campus Curriculum (KMBKM) at Medan State University, Faculty of Mathematics and Natural Sciences, Biology Study Program. The curriculum indicates the need for learning media to facilitate independent learning and various supporting theories of Bioentrepreneurship [32] .
b. Analysis of the curriculum led to the identification of a lack of appropriate learning resources, such as Student Worksheets, for the Bioentrepreneurship course. [33] . This scarcity hinders students from achieving the expected learning outcomes.
c. Based on observations of fourth semester Biology students, it was found that the majority of Biology students aspire to become entrepreneurs (88.8%), have entrepreneurial experience (55.5%), and show entrepreneurial characteristics, such as the courage to take risks and skill. leadership.

In the initial stages of book development, the process included compiling and creating a Bioentrepreneurship-based Student Worksheet Book with a focus on Conventional Food Biotechnology. The book's introduction includes thanks and wishes, followed by a table of contents for easy navigation. The introduction continues with the "Did you know?" section, providing a brief description of the Student Worksheet Book being developed, learning outcomes, an overview of the material, and instructions for use.

Key content is critical, featuring projects that align with predetermined learning outcomes. The contents of the Student Worksheet Book are prepared based on field trials. Each project includes a detailed explanation, activity definitions, implementation examples, and insights labeled "Did You Know." The project covers various topics such as SWOT analysis, ingredient preparation, product manufacturing in the context of Conventional Food Biotechnology, organoleptic testing, packaging, promotion, and ends with financial analysis.

The book concludes without a bibliography or glossary, as references are cited directly in each project. The references for each project are different, so the Reference List in LKM 4 is the final part of the Bioentrepreneur-Based Student Worksheet Book. In the development stage, researchers followed a systematic process to create a Bioentrepreneur-based Student Worksheet (LKM) suitable for the University of Medan. The steps include:

a. Making an LKM book with a focus on didactic requirements, construction and techniques related to Bioentrepreneurship.
b. Validation of the LKM book through assessment by two subject matter experts, a learning media expert, and a Student Worksheet Book design expert.
c. The improvements to this book are based on input from subject matter experts, learning media experts, and design experts.
d. Evaluation of the feasibility and practicality of the LKM book using a questionnaire, involving two Bioentrepreneur course instructors.
e. Conducting small group trials of Bioentrepreneur-based LKM with students to increase creativity and interest in entrepreneurship, followed by assessing feasibility and practicality.

Regarding product feasibility, validation of the LKM book by experts in Conventional Food Biotechnology confirmed "high feasibility". The total score of 136 (85%) reflects this validation, with validator 1 getting a score of 69 (86.2%) and validator 2 getting a score of 67 (83.7%).

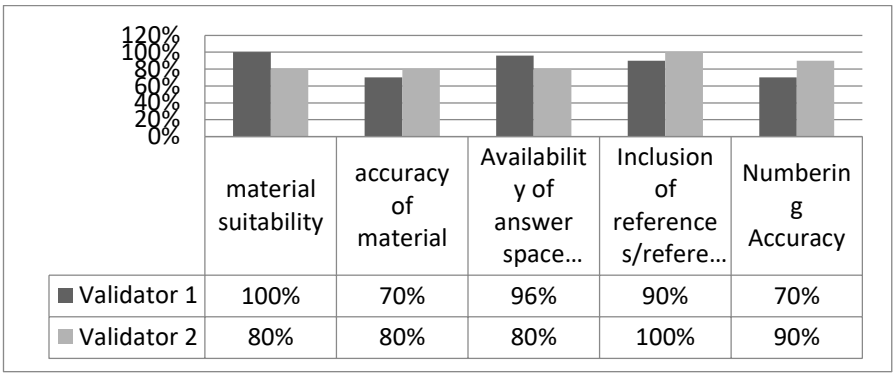


Figure 2 . Gaps in Expert Material Validation Questionnaire Assessment between Validator 1 and Validator 2 for Developing Bioentrepreneurship-Based Learning Modules

The findings of this study highlight significant differences in the scores given by the two validators on various aspects of the assessment. These differences emphasize the distinct and independent nature of their evaluation processes [34] . This assessment of the LKM product which is rooted in Bioentrepreneurship principles is a better version compared to the previous

iteration because it has undergone improvements based on input provided by validators. The Material Expert Validator has explained the Bioentrepreneur-based LKM validation questionnaire. This questionnaire covers various evaluative dimensions, including Appropriateness of Material, Accuracy of Content, Student Accountability in Engaging with Content, Integration of References, and Accuracy in Numerical Ordering. The assessment results are presented in tabular form, providing an interpretation of the Bioentrepreneur-Based LKM Validation Questionnaire by the Expert Material Validation Team , such as figure 2 .

MFIs must be organized following a coherent work flow sequence. This arrangement will help in providing a more logical progression of content to students. The “Did You Know” segment can be expanded to include practical examples or exercises. This addition will contribute to a clearer understanding of the subject matter by students. Each section in the LKM must be classified with more precision. This categorization will help improve the overall structure and navigation of learning materials. The current example used for Break-Even Point (BEP) requires re-evaluation. The example given is considered too general and does not have the necessary profit calculations. It is recommended to use stronger and more contextually relevant BEP illustrations. Media expert validators have identified several errors in the organoleptic testing process. These issues need to be addressed and corrected to ensure content accuracy.

Table 1. Media Expert Assessment of Bioentrepreneur-Based LKM Validation Questionnaire

NO	Evaluation	Total score	Percentage	Interpretation
1	Media Rationality	8	80	In accordance
2	Learning Model Support	13	86.6	Very suitable
3	Syntax	20	100	Very suitable
4	Communication Interactivity	9	90	Very suitable
5	Reaction Principles	14	93	Very suitable
6	Implementation Impact	9	90	Very suitable

Revisions and input provided by the Bioentrepreneur-based Learning Knowledge Module (LKM) Expert Media Validator in the context of Conventional Biotechnology subject matter are as follows: One of the validators suggested that the verbs used in the objectives of each LKM should be in accordance with the appropriate level of Bloom's Taxonomy in the psychomotor domain. This ensures that the expected learning outcomes reflect the desired cognitive skills of students. Another valuable input is to ensure that the references used in the LKM are current and up to date. This ensures that students have access to up-to-date and relevant information in the field of Conventional Biotechnology. Incorporating recent local environmental studies, particularly in the context of a SWOT analysis, was also highlighted as an important addition. This helps students gain insight into the specific challenges and opportunities related to biotechnology in their local context. Regarding competency assessment questions in each LKM, it is recommended that these questions be designed in such a way as to stimulate student creativity and encourage critical thinking. This approach aims to improve students' problem-solving skills and their ability to apply biotechnology concepts in innovative ways.

These revisions and input from Expert Media Validators contribute to improving Bioentrepreneur-based LKM, increasing alignment with current educational principles and industry trends, and ultimately fostering a more effective learning experience for students studying Conventional Biotechnology. Describes the interpretation of the Bioentrepreneur-based Learning Knowledge Module (LKM) validation questionnaire conducted by an Expert

Learning Design Validator. This evaluation includes four different assessment categories: Cover Appearance, Writing Consistency, Illustration Consistency, and Typography.

Table 2. Results Validator assessment of learning design experts

NO	Assessment Category	Total score	Percentage	Interpretation
1	Cover Appearance	28	93.3	Very suitable
2	Consistency in Writing	20	100	Very suitable
3	Consistency in Illustrations	25	100	Very suitable
4	Typography	13	86.6	Very suitable

Proposed revisions and input were provided by the Bioentrepreneur-based Learning Material and Knowledge Expert Learning Design Validator (LKM) in the context of Conventional Biotechnology subjects. The cover design seems to primarily emphasize the LKM's ownership name, thereby obscuring several important images that are intended to be highlighted in the material. Apart from that, the chosen color palette appears relatively darker. The recommended approach involves highlighting product images more than textual elements. Additionally, for the UNIMED logo, it is recommended to position it on a background layer, thereby creating a subtle appearance rather than a prominently displayed image. Typography and Text Clarity: When it comes to text presentation, it is recommended to choose fonts that are easy to read throughout the material. This specifically relates to the title of each chapter and subsection. Ensuring clarity and readability in text elements will contribute to improving the learning experience. This proposed revision and input aims to improve the visual appeal, accessibility and overall effectiveness of Bioentrepreneur-based LKM education on Conventional Biotechnology subject matter, as suggested by the Expert Learning Design Validator.

In the context of research conducted at Medan State University, this research aims to evaluate the effect of implementing the Conventional Biotechnology Food Learning Module (LKM) with Bioentrepreneurship Roots on the N-Gain Value of Biology Students Semester 4 2022/2023 academic year. The investigation includes four dimensions of creativity indicators: fluency, flexibility, originality, and elaboration – all showed positive results, with N-Gain scores ranging from 85% to 100%. This underlines the effectiveness of the LKM approach in enhancing creative thinking among students.

The Bioentrepreneur-based LKM was then tested in a bioentrepreneurship class with two groups, namely the group that used the LKM (Experimental Group) and the group that did not use it (Control Group). Both groups took the same creativity test and answered questionnaires about entrepreneurial interest, suitability, and practicality. The Creativity Test includes Pretest and Posttest evaluation. The pretest assesses initial creative thinking before using LKM, while the posttest assesses creative thinking after using LKM. Results were categorized into indicators of fluency, flexibility, originality, and elaboration

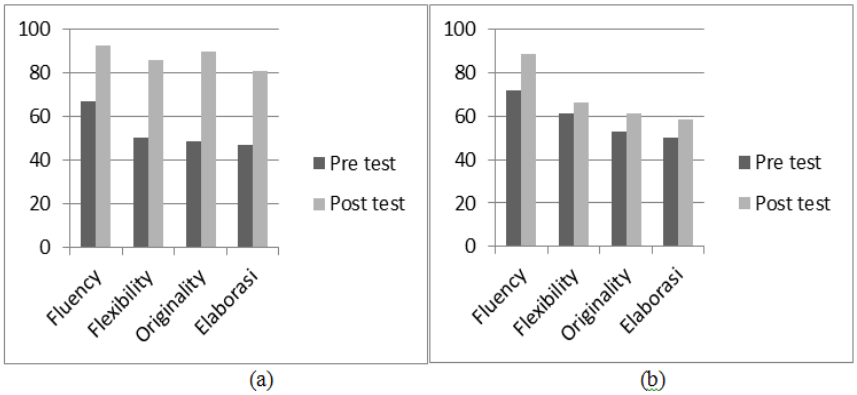


Figure 3. Comparison N-Gain Value Assessment Creativity : (a) Classes that use LKM- based Bioentrepreneur , and (b) Class Without LKM Based Bioentrepreneur

Comparative analysis of fluency N-Gain values between 4th semester Biology students who were exposed to Bioentrepreneurship-based LKM and those who did not utilize LKM showed that LKM users showed a much higher average N-Gain of 47.5 ± 29.23 compared to non-LKM. the user's N-Gain value was 10 ± 15.49 (t = 5.731, P = 0.000). A similar flexibility examination showed that students who used LKM (50.1 ± 21.92) experienced significantly greater N-Gain than students who did not use LKM (5 ± 20.45) (t = 5.601, P = 0.000). This evaluation focused on 4th semester Biology students. In terms of originality, students who were exposed to Bioentrepreneurship-based LKM showed a higher average N-Gain (57.9 ± 25.36) compared to those who were not exposed (9.6 ± 17.32) (t = 7.918, P = 0.000), considering both pretest and posttest scores. Analysis of N-Gain scores for elaboration showed that 4th semester Biology students who took LKM showed significantly higher N-Gain (46.2 ± 24.1) compared to those who did not (9.6 ± 11.83) (t = 6.906, P = 0.000).

Based on the comparison of pretest and posttest scores between the LKM user group and the non-LKM group among 4th semester Biology students at Medan State University, it can be concluded that there is a significant difference in N-Gain results for LKM users. group. In contrast, the non-LKM group showed an increase in pretest to posttest scores, although not very significant.

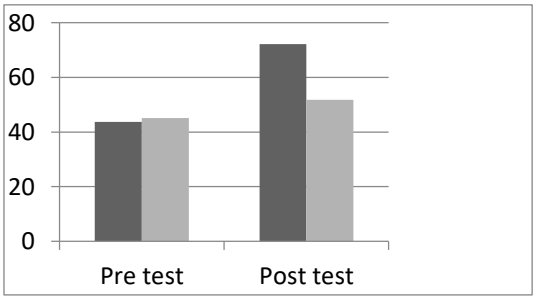


Figure 4. Comparison of Pre-test and Post-test Scores for Classes Using Bioentrepreneur-Based Learning Modules (LKM) and Classes Without Using LKM in Student Trials

Paired Samples T-Test is a statistical technique used to compare the differences between two related sample means, assuming that the data follows a normal distribution. This test shows significant variation between initial and final measurements, with a p value (two-sided) of 0.000, which is less than 0.005. This observation can be seen in the "LKM User Class T-Test" where the paired test assesses the pre-test and post-test scores. The average pre-test score was 21.83, while the average post-test was 36.08. The calculated t value is -11.774 with 23 degrees of freedom and a significance level of 0.000. Likewise, the "Classroom T-Test Without LKM" carries out a similar paired test. Here the pre-test average is 45.08 and the post-test average is 51.77. The resulting t value is -3.495 with 25 degrees of freedom and a significance level of 0.002. A significance level below 0.05 indicates that there is a fairly large difference between the initial and final variables, causing the null hypothesis (Ho) to be rejected and the alternative hypothesis (Ha) to be accepted .

The T-test for the LKM User Class highlighted the significant differences of the pre-test and post-test, indicating the noteworthy impact of the developed Bioentrepreneur-based Learning Module (LKM). The N-Gain test measures the increase in educational outcomes before and after instruction. The N-Gain score is calculated using the formula: N-Gain Score = (Posttest Score – Pretest Score) / (Maximum Score – Pretest Score). For the LKM user class, an N-Gain score of 0.8 indicates high effectiveness, namely 80%. On the other hand, classes without LKM have an N-Gain score of 0.33 which indicates lower effectiveness. When comparing the N-Gain between LKM and non-LKM groups, the average N-Gain of LKM users significantly exceeds (49.6 ± 20.10) than that of non-LKM users (9.06 ± 10.17) ($t = 9.061$, $p = 0.000$). This analysis shows that Bioentrepreneur-based LKM has a positive impact on the creativity of 4th semester Biology students.

Likewise, the assessment of interest in entrepreneurship among students reflects the positive impact of Bioentrepreneur-based LKM. The analysis shows varying levels of effectiveness across various indicators, highlighting how the modules influence students' self-confidence, risk-taking propensity, creativity and innovation, persistence and hard work, future orientation, curiosity and independence. This further underlines the multifaceted contribution of this module in cultivating entrepreneurial attributes among students.

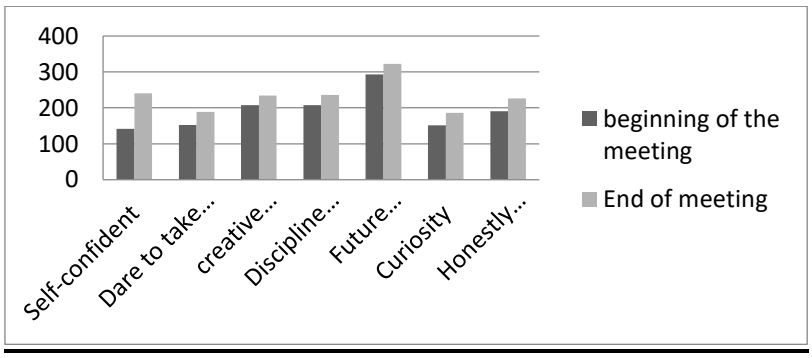


Figure 5. Comparison of Entrepreneurship Interest Levels at the Beginning of the Meeting and the End of the Meeting in Classes Using LKM

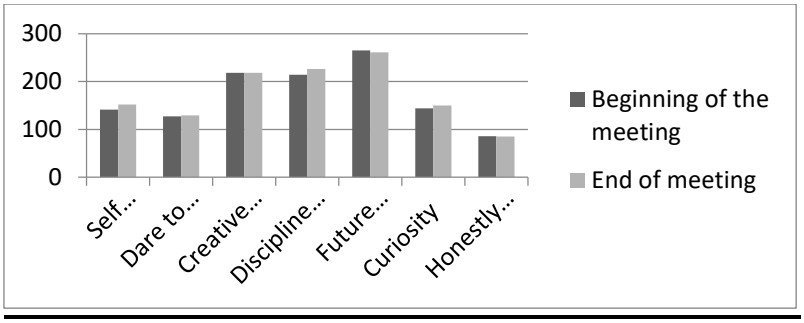
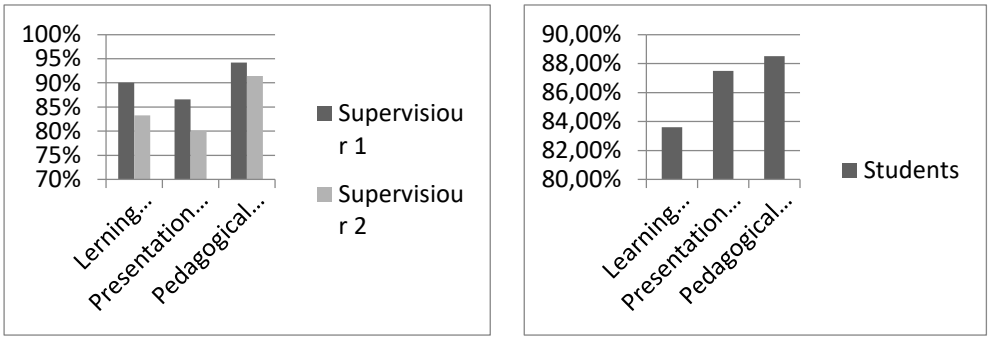


Figure 6. Comparison of Entrepreneurship Interest Levels at the Beginning of the Meeting and the End of the Meeting in Classes that Do Not Use LKM

In this research, student engagement with the Knowledge Learning Module (LKM) produced noteworthy results. First, those who interacted with LKM demonstrated significantly increased levels of self-confidence, as evidenced by significantly higher N-Gain scores compared to their peers who were not exposed to the module. This shows that there is a positive influence of LKM on students' self-confidence. Second, LKM shows a positive impact on students' tendency to take risks. Although the differences in risk-taking propensity between students involved in LKM and the non-exposed group did not reach statistical significance, there was a marked trend toward greater openness in accepting risks. Additionally, students who utilized LKM showed slightly better N-Gain scores in creativity and innovation. Although this difference is not statistically significant, it shows the potential of LKM in fostering creative thinking and innovative approaches among students.

In addition, LKM shows a minor affirmative influence on student discipline and persistence. However, this effect does not reach statistical significance when compared with the non-MFI group, meaning the influence of the module on these attributes is limited. In terms of future orientation, LKM has a slightly less favorable impact on students' views of the future. However, this difference was not statistically significant, indicating that this module did not significantly change the way students view their goals and aspirations for the future.
Regarding curiosity, students who used LKM experienced a slight increase in curiosity compared to their friends who did not interact with the module. Despite the positive trend, the difference in curiosity between the two groups did not reach statistical significance. The application of LKM does not have a significant influence on students' levels of honesty and independence. These attributes appeared to be relatively unchanged across modules, suggesting that LKM may not play a significant role in shaping students' ethical values and autonomy.
In addition, this research explores the feasibility and practicality of Bioentrepreneur-based MFIs. This evaluation underscores the outstanding feasibility and suitability of the module for assessing its efficacy. In research involving fourth semester biology students, a trial was conducted using a Bioentrepreneur-based Learning Module (LKM), the trial used a feasibility questionnaire. Students completed an appropriateness questionnaire about LKM, demonstrating high appropriateness scores (above 85) for learning appearance, presentation, and pedagogical effect. The learning display obtained a score of 602 with a percentage of 83.6%, the learning presentation obtained a score of 315 with a percentage of 87.5%, the

pedagogical effect total score was 744, with a percentage of 88.57%. Where these three aspects are included in the "Very Eligible" category.

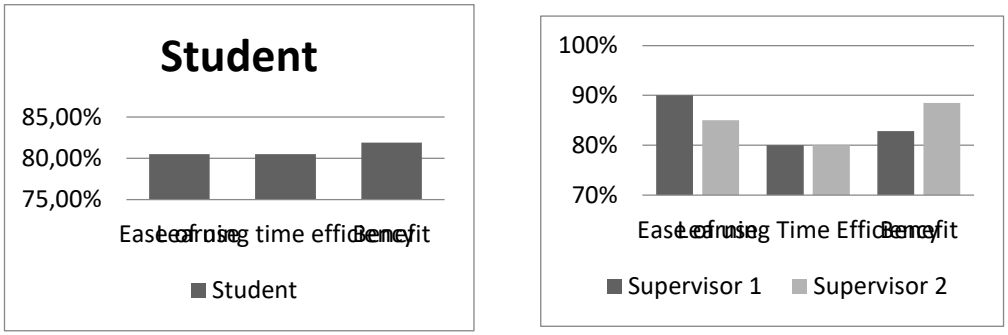


(a) (b)

Figure 7. (a) Comparison of the Practicality Level Assessment of Bioentrepreneur-Based LKM Developed by Instructor 1 and Instructor 2 (b) Practicality level of LKM based on evaluation student

Based on the assessment of the appropriateness level of learning media according to the lecturer, the LKM book developed based on Bioentrepreneur is in the interpretation of "very feasible" with a total score of 142 (88.7%). The results of the assessment analysis from Lecturer 1 obtained a total score of 73 (91.2%) with the interpretation "very appropriate". The results of the assessment analysis from lecturer 2 obtained a total score of 69 (86.2%) with the interpretation "very appropriate".

Based on the assessment of the level of practicality of Bioentrepreneur-based learning media carried out by the supervisor, an interpretation of "very practical" was obtained with a total score of 119 (85%).
Evaluation analysis from Supervisor 1 resulted in a score of 59 (84.3%) with the interpretation "Practical." Likewise, Supervisor 2's assessment received a score of 60 (85.7%) with the interpretation "very practical". A comparative assessment of the level of suitability of Bioentrepreneur-based learning media consists of ease of use, efficiency of learning time, and usability.



(a) **(b)**

Figure 8. (a) Comparison of the Practicality Level Assessment of Bioentrepreneur-Based LKM Developed by Instructor 1 and Instructor 2 (b) Practicality level of LKM based on evaluation student

The analysis explores the results of the Learning Practicality Questionnaire assessment with use MFI Biotechnology- based which is assessed by students in the Medan State University Bioentrepreneur course. This evaluation covers three important aspects , namely : ease of use, obtained a score of 386 with a percentage of 80.5%, learning time efficiency obtained a score of 290 with a percentage of 80.5%, and benefits with a total score of 688, with a percentage of 81.9%. Where these three aspects fall into the "Very practical" category.

3.2 Discussion

The research presented focuses on the development and evaluation of Bioentrepreneurship-Based Student Worksheets on Conventional Food Biotechnology material using the ADDIE development model. This study discusses curriculum analysis, scarcity of learning resources, and student characteristics, highlighting the need for learning media to support the theory of independent learning and bioentrepreneurship. The research findings detail the step-by-step process of creating a Student Worksheet, including cover design, content structure, and learning strategies. The contents of the LKS cover various aspects of Bioentrepreneurship, including SWOT analysis, material preparation, product manufacturing, organoleptic testing, packaging and promotion.

The study then discusses the validation process, where experts in the field assess content suitability, accuracy, engagement, reference integration, and numerical accuracy. The validation results show the high feasibility and suitability of the Bioentrepreneur-based Knowledge Learning Module (LKM), thus showing the potential of the module in improving student learning experiences. Input from expert validators emphasized the need for improvements in layout, clarity, and categorization. Recommendations include improving content organization, improving the “Did You Know” section, and addressing errors in examples and processes, ultimately improving the overall quality of the module.

Further evaluation involved a practicality assessment by the course instructor and small group testing with students. This research shows that there is a positive impact of LKM on the creativity and entrepreneurial interest of 4th semester Biology students. The N-Gain value for creativity and entrepreneurial interest shows the effectiveness of LKM in improving these attributes. A comparison between LKM users and non-users shows a significant difference in creative thinking scores, thus indicating that LKM has a positive effect on student creativity. Additionally, this research explores students' level of entrepreneurial interest, showing that LKM contributes to cultivating attributes such as self-confidence, risk-taking propensity, and curiosity. Feasibility and practicality evaluations confirmed the high suitability and effectiveness of the modules, with positive feedback regarding presentation, usability, efficiency and overall benefits.

The effectiveness of the Bioentrepreneur-based LKM book on students' creativity and entrepreneurial interest was tested using the t test and N-gain test. Based on the t test analysis, it is known that the creativity of students in classes that use Bioentrepreneur-based LKM with material on Conventional Food Biotechnology that has been developed is significantly higher than the creativity of students in classes without Bioentrepreneur-based LKM with Conventional Food Biotechnology material.

Based on the results data that has been presented, it can be concluded that the use of the Bioentrepreneur-based LKM book on Conventional Food Biotechnology material is quite

effective and able to increase students' creativity and entrepreneurial interest. The same research was conducted by Sari (2019) where creativity in both experimental and control classes were tested for normality for the pretest and posttest. Hypothesis H0 is rejected and Ha is accepted. In other words, the use of project-based LKM can increase student creativity. Nugraheni (2018) also conveyed a similar thing, that LKM can attract students to get involved in the learning process. Increasing interest in learning will influence students' creative thinking. Hairida (2016) states that LKM helps students discover concepts independently, and project-based LKM will increase students' fluency, detail, originality and flexibility.

4. Conclusion

Based on the validation results of subject matter experts, media experts and learning design experts regarding Bioentrepreneur Based Student Learning Materials (LKM) with a validation percentage of 85.6% (total score 136) it can be interpreted as very effective. Apart from that, if we look at the influence of using this material on students' creativity, which is indicated by the N-Gain value in the overall creativity aspect, it is included in the effective category. However, the impact of this material on students' entrepreneurial interest was considered "less effective". Considering input from teaching lecturers regarding the suitability of Bioentrepreneur Based LKM, it received a score of 142 (88.7%) with a very suitable interpretation. Apart from that, students' responses regarding the suitability of Bioentrepreneur-Based LKM were categorized as "very suitable". Assessing the level of practicality of Bioentrepreneur Based LKM, the lecturer's response resulted in a score of 119 (85%) with a very practical interpretation. Likewise, student responses stated that the Bioentrepreneur-Based LKM was considered "very practical". Based on the findings presented in the conclusions of this study, several recommendations are proposed:

The LKM book on Conventional Food Biotechnology Based on Bioentrepreneurs can ideally be used by students intensively in one semester. This will ensure that the activities suggested in this book can be implemented effectively with sufficient time. Each worksheet in the Bioentrepreneur-based LKM book requires financial resources. It would be better if students collaborate in groups to facilitate the smooth implementation of activities. For researchers who intend to study the same subject or be involved in developing this thesis research, it is recommended to consider the marketing process or collaborate with an economics study program to address product marketing and break-even point.

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