Validity of Creative Industry-Oriented Metal Forming Module Using Productive Creative Learning Strategies

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Abstract. The goal of this study is to assess the validity of the creative industry-oriented Metal Forming module through the use of productive creative learning methodologies. This module's characteristics include text, photos, and procedures for creating and making innovative industry-oriented goods created from metal resources, with industry parties involved in the module's development. Module development adheres to the ADDIE development model, which includes needs analysis, design and formulation of learning objectives, module creation, and formative assessment. After development, the module is validated by material, learning design, and learning media experts. Questionnaires are distributed as part of data collection strategies for requirements analysis and module validation. The experts' validation assessment criteria for the module use a Likert scale with the following values and categories: 5 for very good, 4 for good, 3 for fairly good, 2 for poor, and 1 for very poor, which are evaluated descriptively. According to the findings, material expert had a validity rate of 90.50%; learning design expert had an accuracy rate of 88.60%; and learning media expert had an accuracy rate of 85.60%. The Creative Industry-Oriented Metal Forming module is found to be very viable for deployment.

Keywords: valididity, module, creative industry-oriented,productive creative

1 Introduction

In the Fourth Industrial Revolution Era, an educational process capable of producing an entrepreneurial, creative, and comparable generation, including university education, must be developed by maximizing the utilization of teaching materials to aid the educational process [1]. The main indicator for a university in producing graduates is no longer the quantity, but the quality of graduates, so to increase the competitiveness of graduates in facing the competitive world of work, universities are required to innovate in the learning process. The competitiveness of graduates is influenced by the application of technology, innovation, and learning strategies by each university [2].

Universities need to implement learning patterns that prioritize concrete creativity based on empirical input from the industrial world so that students are equipped with meaningful knowledge to encourage student enthusiasm to produce creative products [3]. Peter McHardy and Teresa Allan stated that the competencies expected by users include knowledge, problem-solving, communication, and creativity [4].

The development of creative industries in Indonesia is still faced with the challenge of increasing the quantity of education, including availability, educational costs that are

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affordable for all groups of Indonesian society, and suitability and distribution of educational institutions by the potential for developing creative industries in the regions. Apart from that, the quality of creative education in Indonesia is still far behind that of countries whose creative industries have developed, namely related to teaching methods, curriculum suitability, availability of facilities and infrastructure, as well as the quantity and quality of educational staff.

The current Indonesian education system still does not mainstream creativity so students are not yet accustomed to the creative mindset which is the main capital in developing Indonesia's creative economy. According to the Ministry of Tourism and Creative Economy, adequate and quality education is needed to increase the quantity and quality of creative people, one of which is by implementing appropriate learning strategies in the classroom learning process. Productive creative learning strategies are considered the right solution [5].

Productive creative learning can challenge students to produce creative products as recreation [6]. The creative-productive type is a presentation of teaching material by encourages students to develop productive creative ideas [7]. Creativity and productivity are interrelated things and in the learning process, they must be grown simultaneously [8]. Furthermore, Made Wena stated that the implementation of creative-productive learning must be carried out in certain stages. There are five stages of productive creative learning, namely: (a) orientation, (b) exploration, (c) interpretation, (d) re-creation, and (e) evaluation.

The productive innovative education approach is an educational framework that emphasizes learners and their dynamic mental contributions by providing new ideas, responsibility, hard work, and high dedication, as well as constructing their concepts and believing in their creativity and productivity [9]. According to Sawaludin, the productive creative approach to learning supports students to be fluent as well as flexible in their pondering, to be able to see a problem from various perspectives, and to generate many interesting ideas while learning, all while working to create something meaningful [10].

The advantages of creative-productive learning strategies include: 1) comprehending a value, concept, or problem; 2) being able to apply concepts/solve problems; 3) being able to create something based on comprehension; and 4) developing the ability to think critically and creatively, be responsible, and collaborate [11]. Suryosubroto stated the following goals for implementing productive creative learning strategies: the ability to apply concepts/solve problems, the ability to think critically, be creative, and be accountable for the tasks assigned by the teacher. Meanwhile, the following characteristics define this learning strategy: Students are encouraged to discover or construct the concepts under study using a variety of methods of interpretation, including observation, discussion, interviews, reading, experimentation, and internet browsing.

Universitas Negeri Medan is one of the State Universities that continues to make changes to the learning system, resulting in high-quality learning that can assist learners in creating abilities to think critically and imaginatively, particularly learning that focuses on active students or student-centered learning. A quality learning environment can be created by making learning interesting, challenging, fun, and meaningful for students [12]. Universities should emphasize increasing graduates' competency and creativity to prepare students to meet the needs of the workplace or become enterpreneurs. This is consistent with Salli's belief that college graduates' quality standards are measured by workplace-related criteria, such as customer or user satisfaction [13]. In its implementation, graduate quality is a profile of graduates of educational institutions that is consistent with educational qualifications and customer satisfaction, as evidenced by increased interest from external customers in graduates of educational institutions.

Joyce defines learning development as a strategy or pattern for developing a course of study (long learning materials), designing instructional resources, and providing instruction within as well as outside of the classroom [14]. Thus, learning development is a series of steps that include analysis, material development and creation, and learning outcome evaluation to make it easier for users to achieve learning objectives.

Metal Forming is a three-credit course required of Mechanical Engineering Education students at Universitas Negeri Medan. This course is required to produce graduates who are creative in creating products from metal that have economic value. It is hoped that the development of learning modules using productive creative learning strategies can increase the creativity of students taking Metal Forming courses. Learning module development is a systematic activity or process used to create a learning program that achieves specific goals. The process is systematic because the activity components are combined procedurally. Dick [15] refer to this systematic process as the learning design process, which includes both design and development stages. Miarso believes that developing materials for learning within technology for education requires an organized strategy that is coherent, thorough, or comprehensive [16]. Based on the problem description, it is necessary to develop a module for use in the Metal Forming course learning process. The developed Metal Forming module was then tested for validity. This study's development of learning modules is a systematic approach to identifying, developing, and evaluating materials and strategies to achieve specific learning objectives. Initially, the creative-productive learning strategy was called a strata strategy, then with various modifications and developments, this strategy was called creative-productive learning.

2 Method of Research

2.1 Experimental Procedure

The present research employs a research and development approach, in the creation of modules following the ADDIE approach, which includes: 1) Analysis; 2) Design; 3) Development; 4) Implementation; and 5) Evaluation [17]. Module reliability is established through the following phases: evaluation, layout, as well as improvement. The practicality of developing this module was tested on material scientists, learning media experts, and learning design experts. The module is designed for students taking Metal Forming courses at the Dept. of Mechanical Engineering Education, Engineering Faculty, Universitas Negeri Medan. Metal Forming course lecturers are assigned material expert positions based on their area of expertise. Two educational technology instructors were chosen to be educational media and instructional design experts due to their knowledge of the respective fields. The study procedures are illustrated in Figure 1 below.

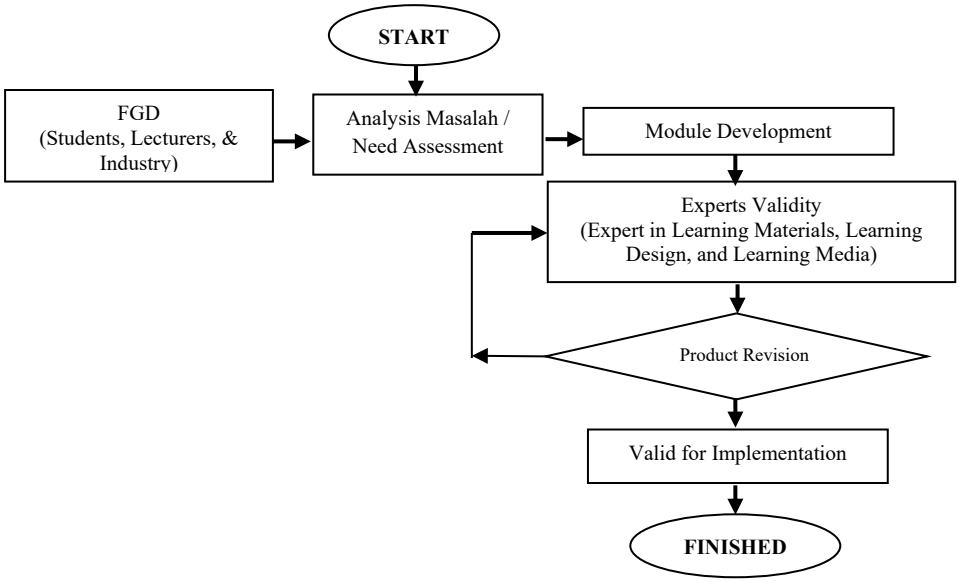

Fig. 1. Research Procedure

2.2 Collecting Data Technique

This study's data collection method was quantitatively examined, as well as the information gathering devices established are associated with the methods for gathering data utilized at every study stage, specifically: a) The list of inquiries within the format of a survey utilized for inquiry, as well as b) Phase data collection instruments [18]. For experts development and validation, a Likert scale-based questionnaire from the LORI vers. 1.5 was used.

2.3 Data Analysis Technique

According to Sugiyono, quantitative descriptive analysis is used in analyzing this type of research data. To sharpen judgment in conclusion, all collected data is quantitatively analyzed and separated by categories. The qualitative data, which consisted of very poor, poor, moderate, good, and very good statements, was converted into a quantitative scale with a 1 to 5 value scale [19]. The results are averaged and used to evaluate the quality of learning media. The module criteria will be converted into Likert scale scores on a scale of five, which will be analyzed descriptively as a percentage using the following formula (1).

$$X = \frac{Total\ score\ obtained}{Total\ ideal\ score\ for\ all\ items} x100\% \quad (1)$$

with the evaluation criteria shown in Table 1 below:

Table 1. Module Feasibility Assessment Criteria

Score	Criteria	Perecentage
5	Very good	81.0 % ≤ x < 100.0 %
4	Good	61.0 % ≤ x < 80.0 %
3	Currently	41.0 % ≤ x < 60.0%
2	Not good	21.0 % ≤ x < 40.0%
1	Very bad	0.0 % ≤ x < 20.0 %

To analyze data from the questionnaire, the following steps are performed:

a. Consult media, material, and learning design experts to validate the media.
b. Validation questionnaires completed by media expert, material expert, and learning design expert are reviewed. If there are any remaining discrepancies during validation, the digital module will be repaired.
c. Using the previously established assessment weights, quantify the validation assessments of media expert and material expert, as well as learning design expert.
d. Organize the data into tables.
e. After that, distribute questionnaires to students to complete, then check and organize them based on the respondent's code.
f. Quantify questions using predetermined weights.
g. Create a table of data.
h. Apply the formula (1) to calculate the score for each subvariable.

Based on the table above, can be used as a reference to see the percentage of module trials categorized as very feasible if the score is > 81.0 %; feasible if 61.0 % ≤ score < 80.0 %; quite feasible if 41.0 % ≤ score < 60.0 %; less feasible if 21.0 % ≤ score < 40.0 %; and very less feasible if the score is < 20.0 %.

3 Results and Discussion

3.1 Results

3.1.1 Analysis Results

The evaluation leads to come from an evaluation of needs that includes surveys as well as findings. Surveys were given out for data subjects, including 30 learners who finished a Metal Forming course. The learning process was witnessed firsthand at the Dept. of Mechanical Engineering Education, Engineering Faculty, Universitas Negeri Medan. Table 2 shows the results of the observations.

Table 2. Metal Forming Course Monitoring Findings

No.	Previous Process of Learning	Answer
1.	Learning goals that are creative and industry-specific.	No
2.	Creativity-based learning module.	No
3.	An introduction, presentation, and conclusion comprise the learning activities.	Yes No
4.	Using Creative Productive Learning Strategies.	Yes

5.	Conduct initial tests of student ability.	No
6.	The lecturer's manual is available.	No
7.	Student handbooks are available.	

Information on graduate competencies expected by graduate users (stakeholders) is known by conducting FGDs with stakeholders. The questionnaire was distributed to four stakeholders, and the outcomes are presented in Table 3.

Table 3. FGD Findings from Graduate Users (Stakeholders)

No.	Statement	Answer (Percentage, %)	
		Yes	No
1	Students know the basics of metal formation.	80	20
2	Students know the formation of sheet metal.	75	25
3	Students know the metal rolling process.	65	35
4	Students know the deformation of mass products.	25	75

Figure 2 shows the results of the Metal Forming learning module design according to the requirements of the Commercial as well as Manufacturing environments, presented as a learning analysis.

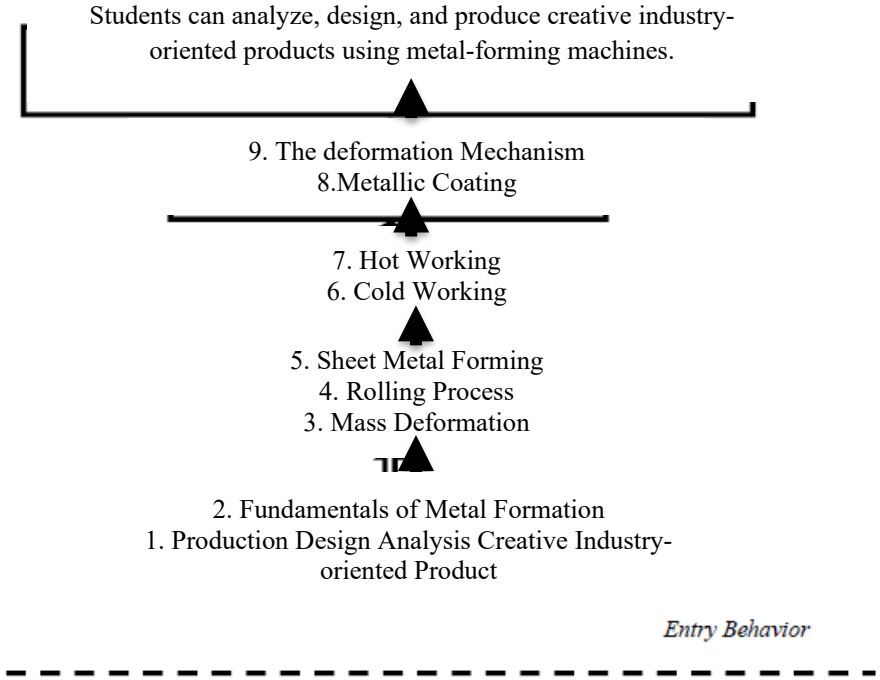

Fig. 2. Learning Analysis in Metal Foarming Corses

3.1.2 Growth Findings

A needs analysis is used to guide module development and validity tests are performed by material experts, learning design experts, and learning media experts at this stage.

A. Findings from Metal Forming Material Expert Validity Test

The validity test for material experts has three components: preparation of learning material, presentation of learning material, and evaluation. Table 4 displays the results obtained.

Table 4. Results of Material Expert Validity Testing

No	Aspects of Evaluation	Score
1	Material Preparation	4,55
2	Presentation of Material	4,50
3	Evaluation	4,52

The mean score calculated based on all three aspects assessed through the material expert was 4.45 (90.50%), which placed the item in the category of very good.

B. Findings from the Learning Design Expert Validity Test

A learning design expert's validity test consists of four components: outcomes of learning, methods of learning, instructional sequence, and evaluation instruments. Table 5 shows the assessment of the learning design expert.

Table 5. Results of Learning Design Expert Validity Test

No	Aspects of Evaluation	Score
1	Learning Outcomess	4,50
2	Learning Strategies	4,57
3	Sequence of Learning Materials	4,40
4	Assessment Tool	4,25

The validation assessment of the learning design expert was very good, with an average score of 4.43 (88.60%) for all four evaluation components.

C. Findings from the Learning Media Expert Validity Test

Expert in learning media validate 5 (five) categories: layout settings, cover appearance, image illustrations, table illustrations, and readability. Learning media expert assessments are shown in Table 6.

Table 6. Results of Learning Media Expert Validity Test

No	Assessment Aspects	Score
1	Layout settings	4,30
2	Cover views	4,33
3	Image illustrations	4,25
4	Table illustrations	4,20
5	Readability	4,32

On the validity test, the media used for learning experts scored 4.28, or 85.60%, putting them into the category of very good. Table 7 displays the findings of the reliability analysis for the learning design, material, and learning media experts.

Table 7. Experts Validity Review

No	Experts	Average Rating	Percentage (%)
1.	Metal Forming Material	4,45	90,50
2.	Learning Design	4,43	88,60
3.	Learning Media	4,28	85,60

3.1.3 Implementation Results

The results of the development of the Metal Forming Course module, which have been validated by experts, are implemented in one-on-one and small-group trials. The data from the one-on-one (3 students) and small group (12 students) tests will be used to revise the module and perfect the final product of the Creative Industry-oriented Metal Forming learning module.

3.1.4 One-to-one Trial

The students were given the design of the metal-forming e-module that would be tested, and they were given three days to study it at home. After the students had completed the metal forming e-module, a questionnaire was distributed to gather feedback and suggestions from the three students. One-on-one trials were conducted on three students: one representing low achievement, one representing medium achievement, and one representing high achievement. The Grade Point Average (GPA) provides information about students' achievements. Table 8 displays the outcomes from the one-on-one examination, including indicators of writing format, material preparation, and visual illustrations.

Table 8. One-to-One Trial Results

No	Indicators	Statement	Score	Average Score
1.	Writing Format	The sentence can be read clearly.	4.67	4.29
		The sentence are easily understood.	4.67	
		Simple to understand language.	4.33	
		Paragraphs are structured and easy to understand.	4.00	
		The use of foreign language is understable.	4.33	
		Sentences with improved spelling.	4.33	
		Sequential numbering system.	3.67	
2.	Materials	Learning objectives are communicated clearly.	4.67	4.19

		Learning materials encorage students to become more creative.	3.67	
		The materials are well organized.	4.00	
		Materials is taken from the most recent literature.	4.00	
		The material is appropriate for student characteristics.	3.67	
		The textbook comes with a glossary.	4.67	
		The textbooks come with evaluation tools (tests).	4.67	
3.	Visual Illustrations	The title can already describe the content of the module.	4.33	3.87
		The cover design can describe the content of the book.	3.67	
		The graphic display is simple to understand.	3.67	
		Illustrations help readers understand the module content.	3.67	
		The table display is simple to undertand.	4.00	
		The colors shown are attractive.	3.70	
		Average One-to-one Test Score		4.12

3.1.5 Small Group Trial

Small group trials were conducted on 12 students who had taken the Metal Forming course. There are twelve students, with four representing low achievement, four representing medium achievement, and four representing high achievement. Student achievement indicators, similar to one-on-one trials, are derived from the student's Grade Point Average (GPA). After the students had read and studied the metal forming e-module, the researchers solicited feedback and suggestions from 12 students. During the meeting, students had the opportunity to ask questions about questionnaire items that they did not understand. The results from the student questionnaire are summarized in the Table 9 below.

Table 9. Small Group Trial Results

No	Indicators	Statement	Score	Average Score
1.	Writing Format	The sentence can be read clearly.	4.33	4.23
		The sentence are easily understood.	4.33	
		Simple to understand language.	4.33	
		Paragraphs are structured and easy to understand.	4.17	
		The use of foreign language is understable.	4.08	

		Sentences with improved spelling.	4.25	
		Sequential numbering system.	4.08	
2.	Materials	Learning objectives are communicated clearly.	4.42	4.13
		Learning materials encorage students to become more creative.	4.00	
		The materials are well organized.	4.25	
		Materials is taken from the most recent literature.	4.17	
		The material is appropriate for student characteristics.	3.92	
		The textbook comes with a glossary.	4.08	
		The textbooks come with evaluation tools (tests).	4.08	
3.	Visual Illustrations	The title can already describe the content of the module.	4.25	4.03
		The cover design can describe the content of the book.	3.83	
		The graphic display is simple to understand.	4.00	
		Illustrations help readers understand the module content.	3.92	
		The table display is simple to undertand.	4.08	
		The colors shown are attractive.	3.70	
		Average One-to-one Test Score		4.12

Table 10 shows the outcomes of the one-on-one test and small-group test, which included indicators of writing format, materials, and visual illustrations.

Table 10. Test Results One-to-One and Small Group

Group Test	Writing Format	Materials	Visual Illustrations	Average Rating	Percentage (%)
One-to-One	4.29	4.19	3.87	4.12	82.40
Small Grop	4.23	4.13	4.03	4.13	82.60

Subsequently, revisions were made based on feedback from one-on-one and small group tests to improve the attractive appearance of the metal-forming module. Figure 3 depicts the revised metal-forming e-module cover.

Fig. 3. Metal Forming Module Cover

3.2 Discussion

The results of developing a creative industry-oriented Metal Forming module, where the module developed will be able to increase graduate competency by the competency required by stakeholders. These competencies are: students can know the basic principles of metal forming, know sheet metal forming procedures, know rolling process procedures, and know mass deformation with all the creative industry-oriented competencies needed by stakeholders.

The results of reliability examinations conducted by material experts, learning design experts, and learning media experts indicate the creative industry-oriented Metal Forming module created using the development framework developed by ADDIE meets the valid standards and can be used to teach Metal Forming classes within the Dept. of Mechanical Engineering Education. The results of the research unquestionably promote Anagün's belief that the skills required in the twenty-first century are skills, specifically creativity-based skills capable of producing innovative industrial products [20].

This research produces a creative industry-oriented Metal Forming module that can supplement instructional resources for instructors, learners, as well as stakeholders, to increase interaction among stakeholders as well as across all levels education system, specifically at Universitas Negeri Medan's Faculty of Engineering.

The creation of this Metal Forming module has several limitations, including the topics that comprise the process of testing, which remain extremely restricted, including 30 (thirty) learners from the Dept. of Mechanical Engineering Education, Faculty of Engineering, Universitas Negeri Medan, so the quality of the module being developed must be tested again on other subjects in the study programme. Mechanical Engineering Education at various universities. As a consequence of the study's findings, this is anticipated that the developed module can be used by the Dept. of Mechanical Engineering Education, Engineering Faculty, Universitas Negeri Medan, alongside other stakeholders who may require it in the future.

4 Conclusions

Examining the outcomes of the study and the discussion of each module developed, the conclusions that follow may be reached:

a. The resulting learning media is a metal-forming e-module that is valid, practical, and follows the ADDIE development cycle. This model consists of five stages. The first stage is Analysis, the second is Design, the third is Development, the fourth is Implementation, and the final stage is Evaluation.
b. Based on the requirements evaluation, there are currently no available books, modules, or directives for creative industry-oriented metal forming learning. Module development produces a metal forming module with materials: basic principles of metal forming, sheet metal forming, mass rolling, and deformation processes with all the creative industry-oriented competencies required by stakeholders.
c. The validity of the creative industry-oriented Metal Forming module that has been developed is declared very valid for applied in classes for Mechanical Engineering Education students. This is demonstrated by the validation results of material expert 4.45 (90.50%), instructional design expert 4.43 (88.60%), and instructional media expert 4.3 (83.10%). From the experts assessment, the average value was obtained. amounted to 4.28 (85.60 %), including valid criteria.

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