JPPIPA 11(8) (2025)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

Effectiveness Test of Learning Devices in the Computer-Aided Manufacturing (CAM) Course

Robert Silaban[1*], Binsar Maruli Tua Pakpahan[1], Ana Rahmi[2], Hidir Efendi[1]

[1] Mechanical Engineering Education, Faculty of Engineering, Universitas Negeri Medan, Medan, Indonesia.
[2] Department of Family Welfare Education Faculty of Engineering, Universitas Negeri Medan, Indonesia.

Received: May 1, 2025
Revised: July 15, 2025
Accepted: August 25, 2025
Published: August 31, 2025

Corresponding Author:
Name Robert Silaban
robertsilaban62@gmail.com

DOI: 10.29303/jppipa.v11i8.11223

Abstract: The aim of this research is to develop learning devices, including the syllabus, Semester Learning Plan (RPS), teaching materials, and assessments for the Computer Aided Manufacturing (CAM) course, whose suitability has been tested. The needs analysis is related to the transition from the Competency-Based Curriculum to the Indonesian National Qualifications Framework (KKNI) curriculum, which requires various adjustments. For instance, assessments in the Competency-Based Curriculum consist of four (4) components, while the KKNI curriculum includes six (6) components, with cognitive assessment contributing the most. In its implementation, the Competency-Based Curriculum uses learning devices aligned with its structure. With the adoption of the KKNI curriculum, it is deemed necessary to develop learning devices that support its implementation. This research employs the 4-D model as the basis for the development procedure. The results of the first stage, based on expert evaluations, indicate that the Semester Learning Plan and CAM teaching materials meet the criteria for being highly suitable as learning devices for the CAM course. Additionally, student evaluations confirm that the Semester Learning Plan and CAM teaching materials are appropriate for use as learning devices. The effectiveness test results show a significant increase in post-test scores compared to pre-test scores. Furthermore, the t-test analysis confirms a statistically significant difference between the average post-test and pre-test scores.

Keywords: 4-D model; Computer-aided manufacturing (CAM); Effectiveness evaluation; KKNI curriculum; Learning device development

Introduction

Learning at the tertiary level must refer to the regulation of the Minister of Education and Culture of the Republic of Indonesia concerning the standard processes and characteristics of the learning process in the study program to obtain graduate learning outcome (Ristek-Dikti, 2015). Following the Indonesian National Qualifications Framework curriculum, the D-3 Mechanical Engineering Study Program curriculum states that in CAM subjects the D-3 Mechanical Engineering Study Program graduate possesses competencies that can design workpieces with CAD Software, able to define material with CAM software, able to define Stock size, able to set system coordinates, able to choose tools, able to determine feed speed and rotation, able to simulate machining, able to simulate post-processing, able to edit CNC programs produced from CAM (Computer Aided Manufacture) program applications that can be installed/integrated in a CNC machine. To achieve competence above the role of learning tools is an important part of conducting lectures. Through learning tools lecturers will find it easier to carry out lectures and students will be more helped and easier to learn. Learning tools can be made in various forms according to the needs and characteristics of the teaching material to be presented (Permendiknas, 2008).

Addressing the existing problems then alternative solutions are needed. This alternative solution allows to

How to Cite:
Silaban, R., Pakpahan, B. M. T., Rahmi, A., & Efendi, H. (2025). Effectiveness Test of Learning Devices in the Computer-Aided Manufacturing (CAM) Course. *Jurnal Penelitian Pendidikan IPA*, *11*(8), 855–866. https://doi.org/10.29303/jppipa.v11i8.11223

cover and meet all the needs that exist in the field. Alternative solutions for the use of learning tools that can improve the quality of lectures. Learning tools are a number of materials, tools, media, instructions, and guidelines used in the learning process. This learning tool consists of teaching materials, assessment (assessment), and learning models used (Anggreani, 2017).

The development of learning tools has many benefits both for lecturers and for students. Given the importance of the use of learning tools in lectures in the D-3 Mechanical Engineering study program, researchers are encouraged to conduct research into the development of CAM course subjects. In the first phase of research the author has developed the CAM course learning tools, and the results of the first phase of the assessment of the material experts indicate that the CAM Course Semester Learning Design and CAM Teaching Materials have met the criteria very suitable for the use of CAM learning tools, then based on the assessment of college students that the Design CAM Semester Learning Course and CAM Teaching Materials have met the criteria suitable for use as CAM learning tools. This phase II study focused on testing the effectiveness of the CAM learning device (Depdiknas, 2008).

The Research Objectives can be described as follows, to develop CAM Learning Tools in accordance with the Indonesian National Qualification Framework curriculum that can support the implementation of Computer Aided Manufacture (CAM) learning and to test the effectiveness of learning devices (Ferda et al., 2018).

The learning tools developed and tested in this study are expected to provide valuable insights for both theorists and practitioners of CAM (Computer-Aided Manufacturing) education in fostering intelligent learners with strong critical thinking skills. By evaluating the effectiveness of these tools, developers of CAM instructional materials can design learning experiences aligned with the Indonesian National Qualification Framework (KKNI) (Wojowisoto, 1980). Furthermore, the outcomes of this research may serve as useful references or benchmarks for other researchers and instructional designers. These tools may also be adopted by practitioners as alternative learning resources that comply with KKNI standards, which are still relatively underdeveloped in Indonesia.

Teaching materials refer to instructional content or subject matter that is systematically and comprehensively organized based on educational principles, and are used by both teachers and students during the learning process. The systematic nature of teaching materials facilitates students' understanding by presenting information in a logical sequence. Moreover, teaching materials are considered unique and specific—unique in the sense that they are designed for particular learning objectives and target groups, and specific because they are tailored to achieve certain competencies within defined contexts (Pannen, 1996).

These materials may be either written or unwritten. According to several experts, teaching materials constitute a structured set of content—whether in written or non-written form—designed to create a conducive learning environment (Nurhasanah, 2017). In essence, teaching materials represent the "content" of a curriculum, consisting of subjects, topics, subtopics, and detailed learning objectives (Pinahayu et al., 2018).

Given this, the teacher's role in designing and developing teaching materials is critical to the effectiveness of the learning process (Kemdikbud, 2025). Teaching materials encompass all resources used to support instructional activities, including textual documents, handouts, slides, diagrams, images, photographs, as well as multimedia formats such as audio, video, animations, and computer-based or web-based content (Butcher et al., 2006).

Dick & Carey (2009), as cited in Yaumi, also use the term instructional materials to describe a broad range of teaching resources, including instructor guides, student modules, overhead transparencies (OHPs), videotapes, multimedia computer applications, and web-based learning platforms for distance education (Yaumi, 2016).

Based on the aforementioned perspectives, it can be concluded that a learning model is a plan or framework used as a guide for organizing classroom instruction. It serves as a general pattern of teaching and learning behavior aimed at achieving desired competencies or learning objectives. A learning model encompasses the interaction between students and teachers in the classroom, including the approaches, strategies, methods, and techniques applied during the teaching and learning process (Marliani, 2015).

Moreover, a learning model not only outlines the actions required from the teacher, but also specifies the stages of instruction, the principles governing teacher and student responses, and the necessary support systems to ensure effective implementation.

Sujadi, as cited in Novita Anindita, defines development research as a process or a series of steps aimed at creating new products or improving existing ones in a responsible and accountable manner (Saputro et al., 2020). In this context, researchers are required to design, compile, and implement a particular product, which is then tested and revised accordingly. This explanation highlights that producing high-quality learning tools requires a gradual and continuous development process, involving multiple stages of testing and refinement.

Learning tools are considered to be of high quality if they meet three main criteria: validity, practicality, and

effectiveness. A tool is considered valid when all of its components are consistently aligned with the characteristics of the applied learning model. It is deemed practical if it is easy to use and can be implemented effectively (Gusmira et al., 2017). Lastly, it is considered effective if it enables the achievement of the intended learning outcomes. Therefore, the validity, practicality, and effectiveness of learning tools play a critical role in fostering a conducive learning environment and achieving desired educational goals (Aidin, 2019).

At the tertiary level, learning must adhere to standard processes to ensure the attainment of graduate learning outcomes. One such standard is the characteristic of the learning process itself. To achieve high-quality instruction, it is essential to use learning tools—such as teaching materials, assessment instruments, and learning models—that have been proven effective and align with the curriculum requirements of the Indonesian National Qualification Framework (KKNI) (Iskandar et al., 2018).

Method

The design used in the research development of learning tools uses the steps of the Define, Design, Develop, and Disseminate Four-D research design (Thiagarajan, 1974). The development steps are arranged as in Figure 1.

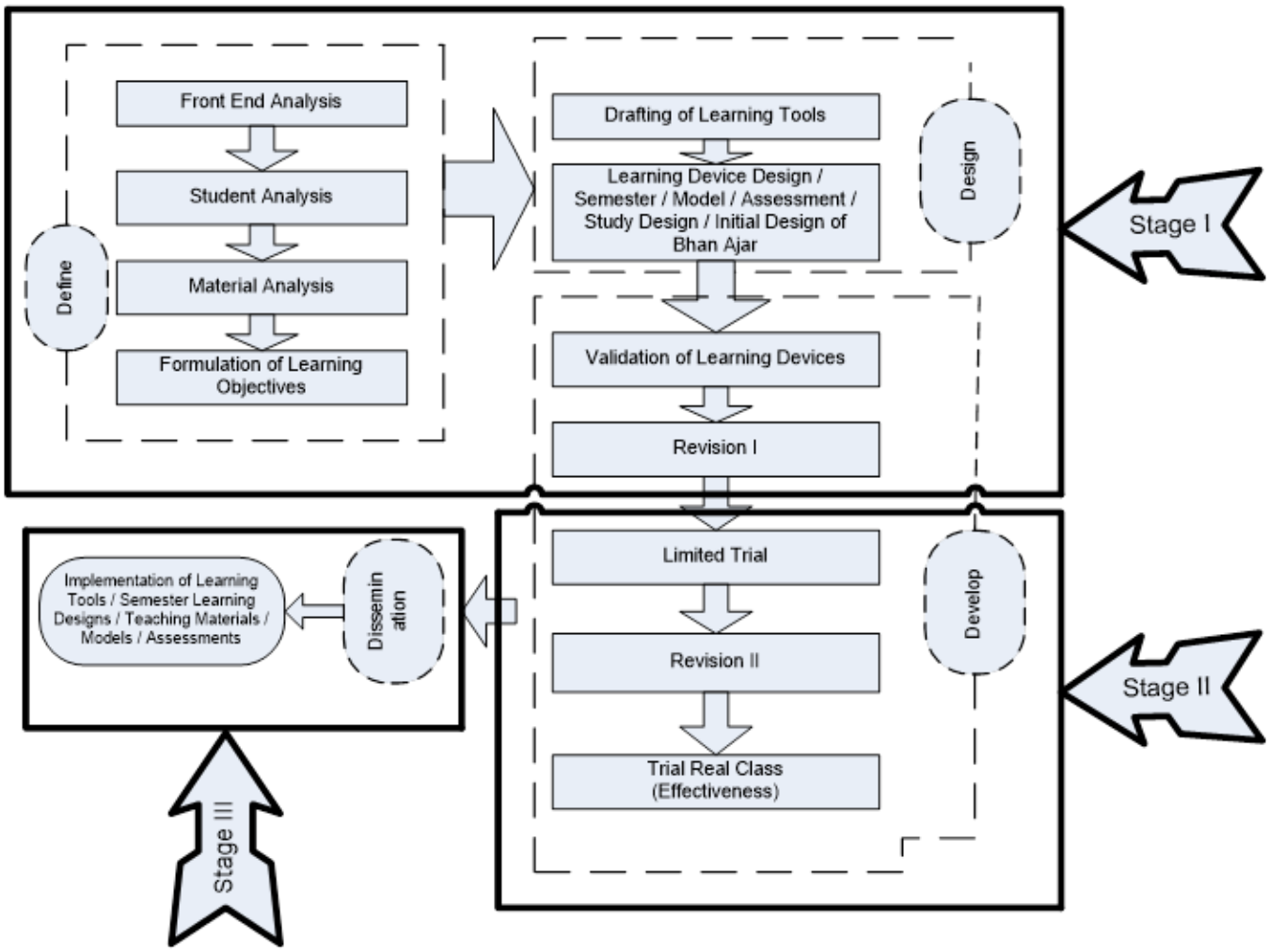


Figure 1. Chart of research and development models

The research and development cycle is known as "the R&D cycle" (Borg et al., 1998), is presented in the fishbone Figure 2.

This research was designed to be carried out in 3 stages for three years. Phase I is development research to develop teaching materials and their guidelines, and conduct research into the development of learning and assessment models. Phase II is a mixed method design research to determine the implementation and effectiveness of teaching materials, learning models and assessments that have been developed and in stage III dissemination.

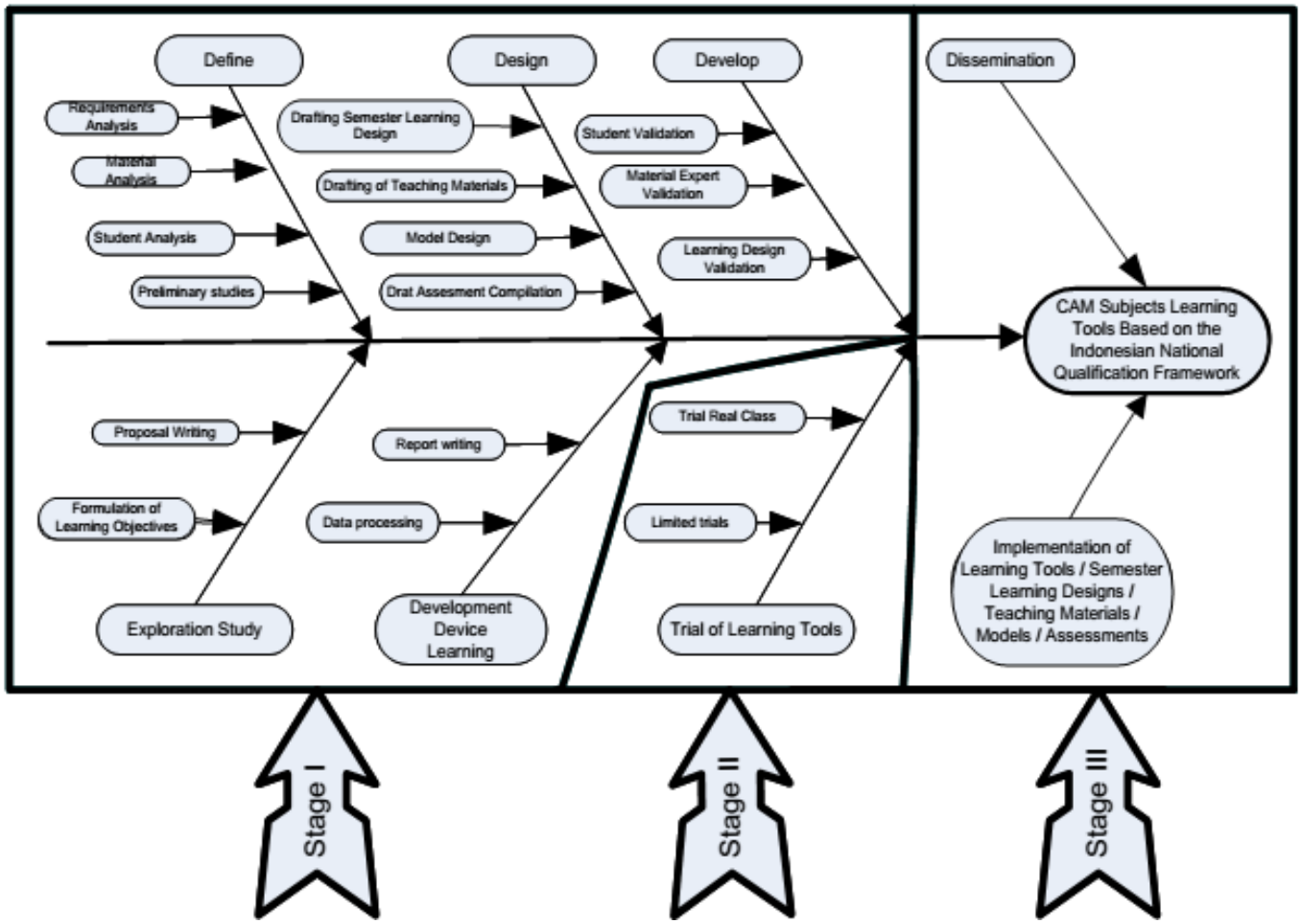


Figure 2. Fishbone development research CAM subjects learning tools based on the Indonesian national qualification framework

This research was conducted in the D-3 Mechanical Engineering Study Program, Faculty of Engineering, State University of Medan. The subjects of this study were students of the Mechanical Engineering Study Program D-3 whose learning there was practicum especially in the class of 2017 as a force that had applied in the implementation of the Indonesian National Qualification Framework.

Data collection techniques used in this study, are questionnaire and interview techniques, as well as documentation techniques to capture data in needs analysis activities, questionnaire techniques to capture data about the responses of students and students in the activities of expert validation and one-on-one trials and group trials small, and test and observation techniques in field trial activities are limited. Data analysis techniques used are: (1) descriptive analysis to describe the data from the needs analysis and expert validation as well as one-on-one and small group trials. (2) t-test to determine differences in the effectiveness of the model for limited and broad-scale field tests.

Table 1. Research Data Categorization

Interval Value	Category
X >3.25	Very appropriate
2.5 < X < 3.25	Corresponding
1.75 < X< 2.5	It is not in accordance with
X < 1.75	Very Not Suitable

For the scores obtained are converted into scores on a scale of 4 (Agustin et al., 2017) with the categorization of assessment scores: X> Mi + 1.5 (SDi) Very helpful, Mi <X <Mi +1.5 (SDi) helps, Mi - 1.5 (SDi) <X <Mi does not help, X <Mi - 1.5 (SDi) is not very helpful where Mi is the ideal mean (Mi) and Sdi = deviation (SDi) obtained by the formula: Mi = ½ (highest score + lowest score), SDi = 1/6 (highest score - lowest score) (Mardapi, 2008). The categorization of research data is presented in Table 1.

Result and Discussion

The first stage of development is Planning: To support the implementation of a curriculum aligned with the Indonesian National Qualification Framework

(KKNI), it is deemed necessary to develop learning tools that are also based on KKNI principles.

The second stage is Design: This stage involves formulating the learning outcomes for the CAM (Computer-Aided Manufacturing) course, identifying indicators of these learning outcomes, developing CAM learning materials, creating CAM learning guidelines, and designing six student assignments.

The third stage is Development: This includes organizing the learning tools, such as the Semester Learning Plan (RPS) for the CAM course and the CAM teaching materials. It also involves the validation of these learning tools, the implementation of the devices in CAM course instruction, and the presentation of the results of both validation and implementation (Syah, 2007).

Statistics of Conformity Scoring Assessment of CAM Subject Semester Study Design According to Expert Material is presented in the following figure 3.

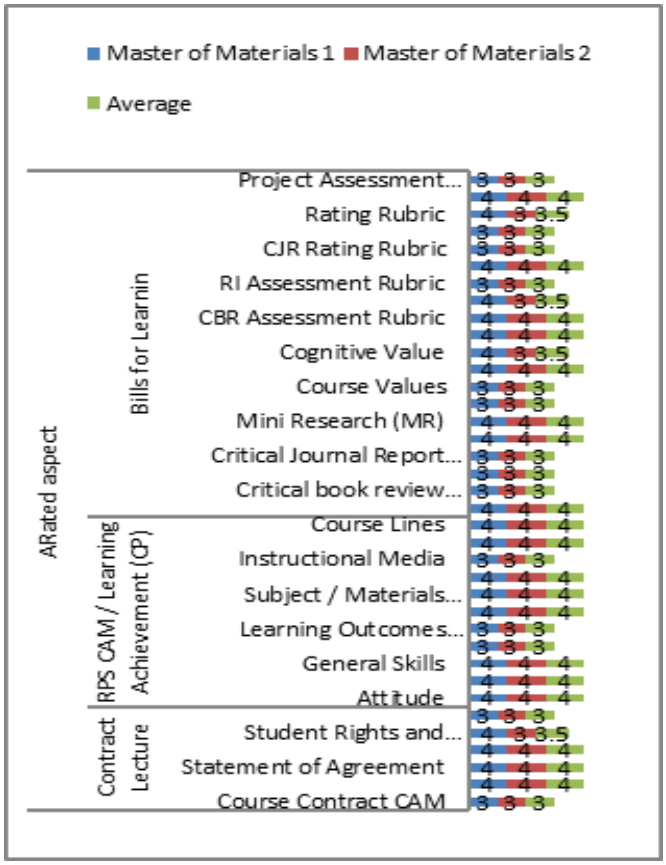


Figure 3. Statistics all aspects of conformity assessment of the design of CAM subjects courses according to material experts

Furthermore, the overall statistics of the evaluation aspects of the design of the CAM course subjects according to Expert Material are presented in Figure 4.

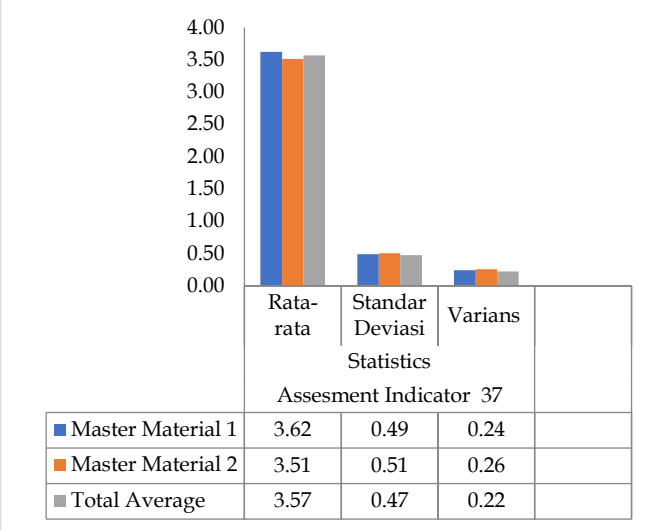


Figure 4. Statistics overall assessment aspects the learning design of the CAM course semester

The Suitability of CAM Course Semester Learning Design According to Expert Material are presented in Figure 5.

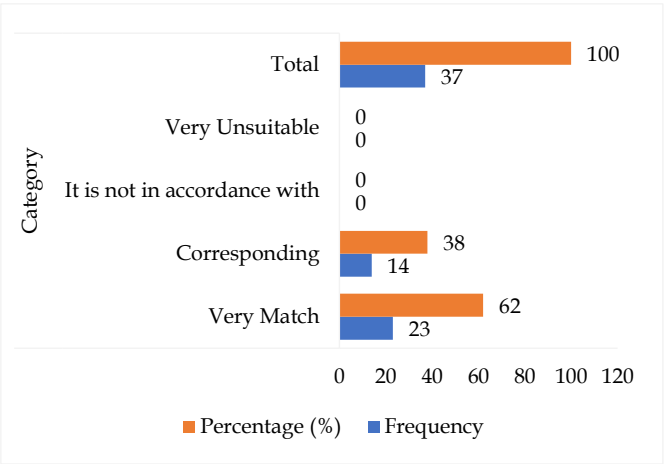
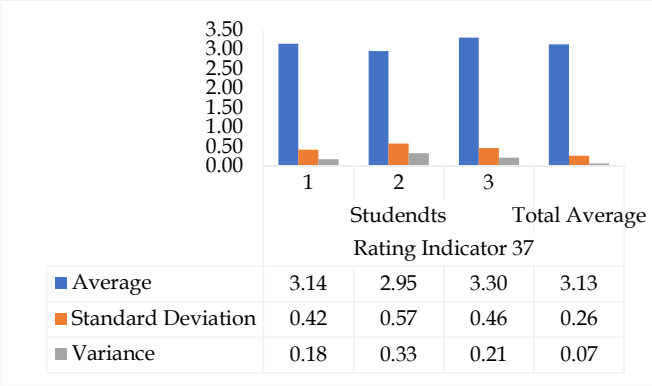


Figure 5. Statistics and conformity of the design of CAM subjects semester learning according to expert material

Based on the picture above it can be interpreted that the suitability of the CAM Course Semester Learning Design in terms of the average of all aspects of the assessment shows that out of 37 aspects of the assessment 23 items (62%) in the category are very suitable and 14 items (38%) in the categories are appropriate. Furthermore, material expert score 1 is 134, material expert 2 is 130, and second (100%) material expert gives a very appropriate assessment (Anindita, 2013). The average total of the two material experts is 3,568, these results indicate that the CAM Course Semester Learning Design meets the criteria very suitable for use in the CAM learning tool.

Individual trials were conducted on 3 college participants consisting of one high achiever, one

medium achiever, and one low achiever (Thiagarajan, 1974). The aim of this individual trial was to identify the shortcomings of the Semester Learning Design and CAM course material as learning tools. Statistics on the results of individual trials of semester learning designs can be seen in Figure 6.

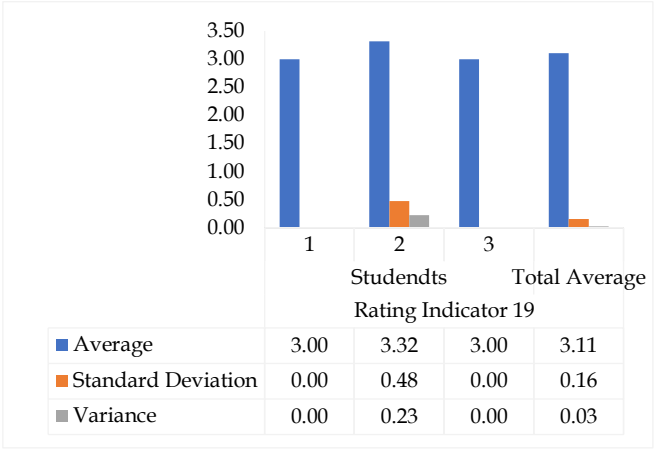


Average	3.14	2.95	3.30	3.13
Standard Deviation	0.42	0.57	0.46	0.26
Variance	0.18	0.33	0.21	0.07

Figure 6. Summary of statistical data on individual trial results semester learning design

Based on the results of the learning participant assessment data on the CAM Course Semester Learning Design developed as in Table 1 above and figure 10 it can be concluded that the CAM lesson semester learning design is in good criteria with a total average of 3.13, but it still needs improvement.

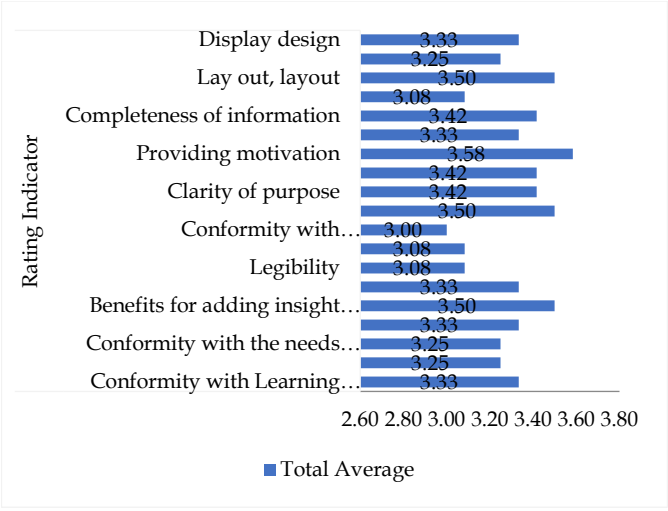
Furthermore, the results of individual trials of teaching materials for CAM courses are presented in figure 7. Based on the results of the assessment data of learning participants on the CAM Subjects Teaching Materials developed as in Table 4.2 above and figure 7 it can be concluded that the CAM Subjects Teaching Materials in very criteria with a total average of 3.11, but still needs improvement.



Average	3.00	3.32	3.00	3.11
Standard Deviation	0.00	0.48	0.00	0.16
Variance	0.00	0.23	0.00	0.03

Figure 7. Statistics on individual test results of teaching materials

After going through the improvement in the learning tool components of individual test results, then a small group trial is then conducted at the research site conducted on 12 participants in the 2017 semester consisting of four high-achieving college participants, four moderate-achievers, and four high achievers low. This small group trial data is intended to find out some of the weaknesses or difficulties faced by participants when learning tools are used in CAM lectures. The learning kit that was piloted in this small group was used as the initial product before the CAM course learning tool based on the Indonesian National Qualification Framework was trialed to the field. The results of a small group trial of teaching materials can be seen in Figure 8.



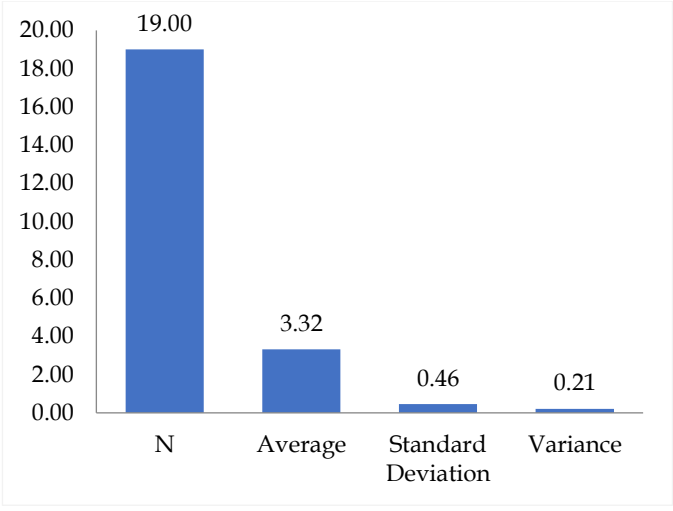


Figure 8. Results of small group trials of cam subjects

Based on the results of student assessment data of small group test participants on teaching materials that have been improved and developed as in Table 1 above it can be concluded that the average results of teaching

material assessment of 3.32 results are included in the criteria Very appropriate. Thus it can be used as teaching material for CAM course learning.

Furthermore, results of small group trial planning for semester learning can be seen in figure 9.

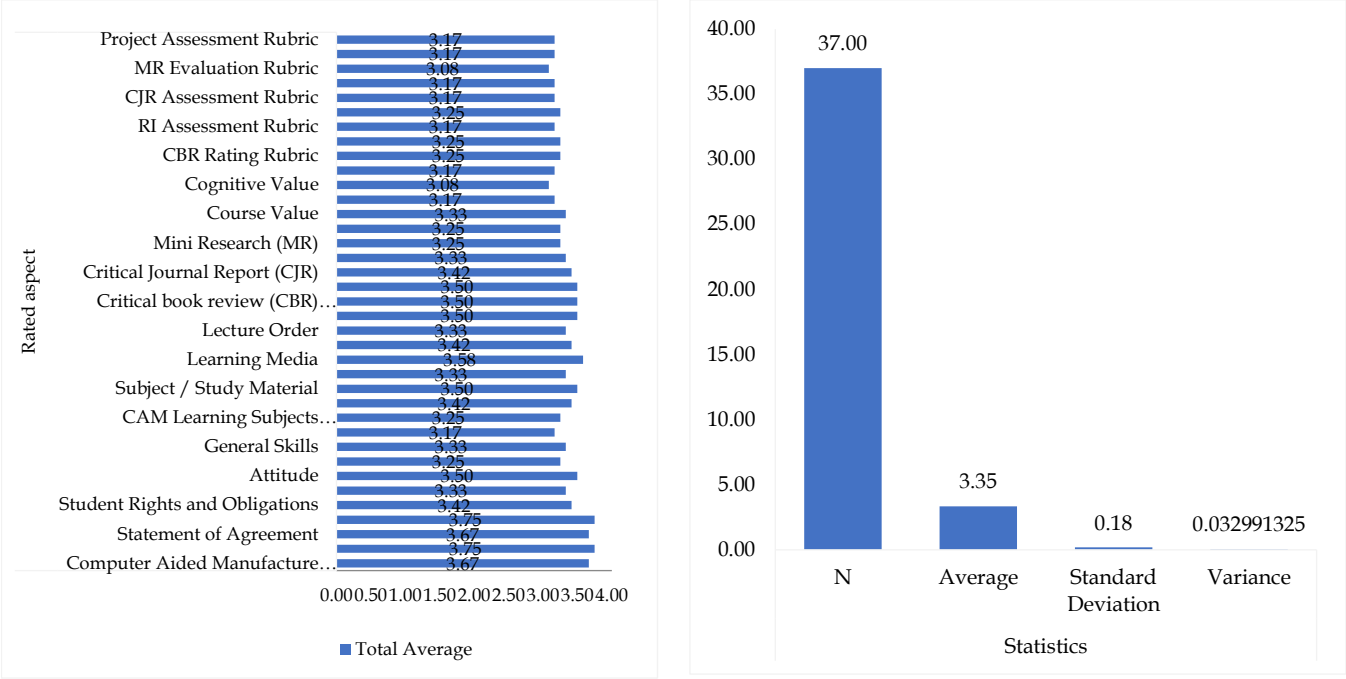


Figure 9. Results of small group trial planning for semester learning

Based on the assessment of students in the small group test participants on the CAM Course Semester Learning Design developed as in Table 4 and Figure 9 above it can be concluded that the average total CAM lesson semester learning design assessment is 3.35 being in very suitable criteria, thus it can be used as a Design Learning Semester CAM course learning (Borg et al., 1998).

Furthermore, based on the assessment results Teaching materials with a total average of 3.32 and the average semester course design total of 3.35, both of which are in the very appropriate category, it can be concluded that the semester learning design and CAM course teaching materials can be used as CAM learning subjects.

A summary of the statistical data on trends in the effectiveness of teaching materials is presented in figure 10. Based on the student's assessment of the CAM course Teaching Materials used as shown in table 1 and Figure 10 shows that out of 15 college students, 12 people (80%) said that the CAM course teaching materials were very helpful and 3 people (20%) said helpful, the average total assessment of Teaching Materials for the CAM course is 3.42 which is in the very helpful criteria. Thus it can be concluded that Teaching Materials can be used as a learning tool for the CAM course (Borg et al., 1998).

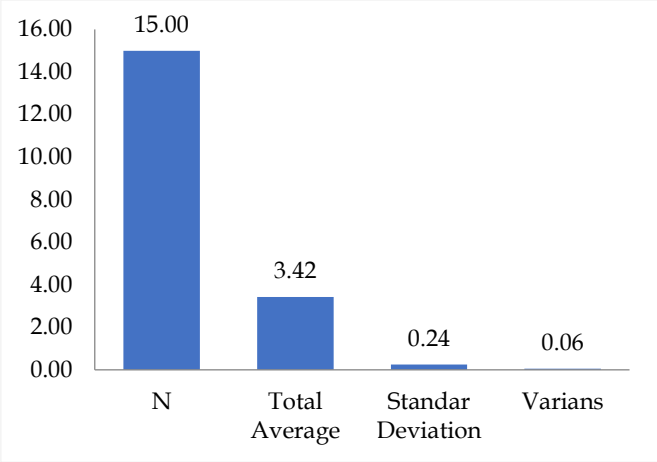


Figure 10. Summary of statistical data on trends in the effectiveness of teaching materials

Data on the trend of the level of effectiveness of the 6 tasks showed that out of 15 students 33.33 percent (5 people) indicated that the CAM learning tool was very helpful, 66.66 percent (10 people) showed it was helpful and no one showed it was not helpful or very unhelpful and the overall average 3.23 is included in the helping category. These results indicate that CAM learning tools for 6 tasks have significant effectiveness in learning CAM courses. The frequency trend of the level of effectiveness of CAM learning tools for 6 tasks is presented in Figures 11 and 12.

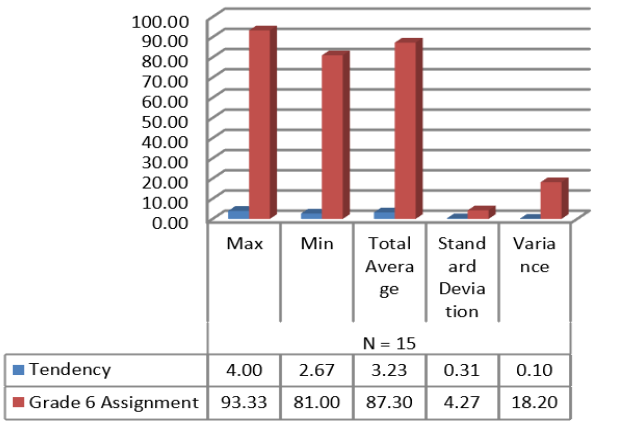


Figure 11. Statistics on the effectiveness of 6 tasks

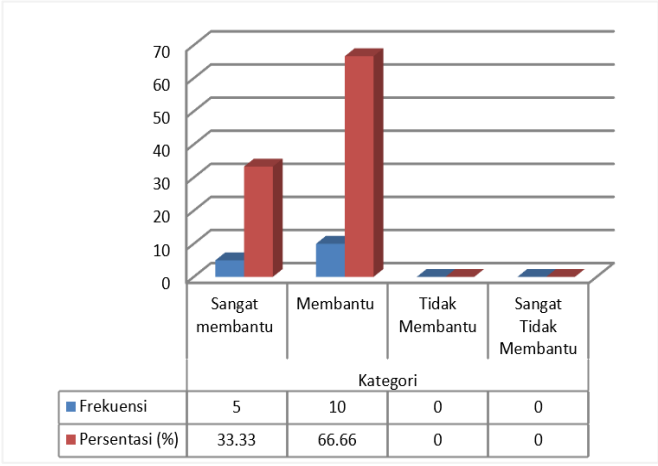


Figure 12. Percentage of the effectiveness of 6 tasks

A summary of the value of 6 student assignments is presented in Figure 13.

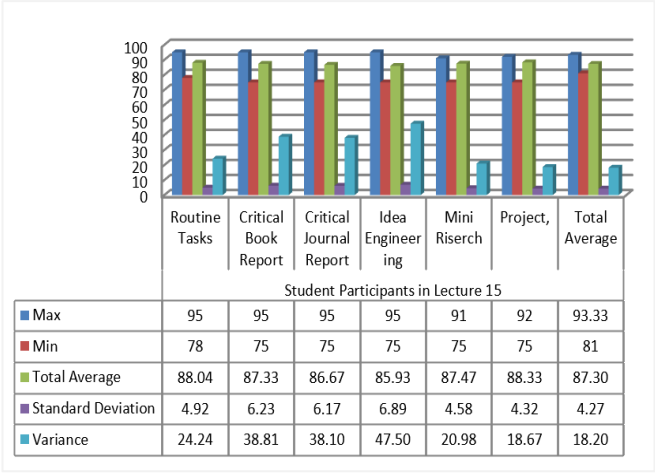


Figure 13. Summary of grades for 6 assignments

The results of the calculation of the value of 6 assignments showed for 15 students the highest score was 95, the lowest score was 75 and the average value was 87.3.

In accordance with the steps of development research, the initial activity before developing the CAM Subjects Learning Kit is needs analysis. Analysis of needs in the form of relating to the change of the Competency Based Curriculum to a curriculum based on the Indonesian National Qualifications Framework which automatically requires adjustments in many cases, for example, the assessment of the competency based curriculum consists of 4 components, namely formative value 1, formative value 2, formative value 3 and formative value 4 while in the indonesian national qualifications framework curriculum consists of 6 components namely: 1) Routine Tasks, 2) Critical Book Review, 3) Engineering Ideas, 4) Critical Journal Report, 5) Project Work, 6) Mini Research plus cognitive or skill assessment which has the biggest contribution. In its operation in the assessment of the Competency-Based Curriculum using tools that are in accordance with the Competency-Based Curriculum. With the application of a curriculum based on the Indonesian National Qualification Framework it is felt necessary to develop learning tools that support the application of the Indonesian National Qualification Framework curriculum. After the needs analysis is complete and clear, the next step is to collect reference sources that support the development of learning tools between other sources of teaching materials, relevant media, the idea of developing CAM Subjects is developed.

At the Design stage the authors formulate CAM course learning achievements, including: Attitude: S9 = Demonstrating a responsible attitude for work in the field of expertise independently; Knowledge: P4 = Mastering general theoretical concepts about CAM software; General Skills: KU 2: Demonstrate performance with measurable quality and quantity, KU 5: Responsible for achieving group work; Special Skills: KK 6: Able to use CAM Software in designing machine components including creating CNC programs that are produced from CAM (Computer Aided Manufacture) programs that can be integrated in CNC machines, this formulation is based on the current Indonesian National Qualification Framework curriculum.

Still in the design phase the authors formulated learning achievement indicators, including: 1) Being able to make two-dimensional and three-dimensional designs; 2) Able to define material; 3) Able to define Stock size; 4) Able to select coordinate systems; 5) Able to define a Tool; 6) Able to determine the speed and speed of feed (feed and speed); 7) Able to simulate machining; 8) Able to simulate Post Process. In accordance with the above indicators the following CAM course learning materials are formulated, including: 1) Material relating to the two-dimensional

and three-dimensional design; 2) Material relating to defining material; 3) Material relating to defining Stock size; 4) Material relating to the selection of the coordinate system; 5) Material relating to defining the Tool: 6) Material relating to determining the rotation and feed speed (feed and speed); 7) Material related to simulating machining; 8) Material related to simulating post proces.

Associated with the above description is also in line with the spirit of the Indonesian National Qualifications Framework the authors formulate: 1) 10 routine tasks that are divided into two groups consisting of: a) Routine tasks 1 to 4 students are expected to understand the main menu commands and sub menu Mastercam For this reason, assignments 1 to 4 are tasked with defining/translating Mastercam commands into Indonesian: b) Routine assignments of 6 to 10 students are expected to do the exercises in accordance with the steps that have been prepared in teaching materials. 2) Formulating Engineering Ideas; 3) Formulating the Critical Book Report; 4) Formulate Critical Journal Report; 5) Formulate Project Work; 6) Formulate Mini research that will be done by students for one semester.

Furthermore, in the depelopment stage, the writer organizes a Learning Kit consisting of CAM Semester Study Design. Semester Learning Plan with items containing at least: 1) Name of study program, course name and code, semester, credits, name of supporting lecturer; 2) Achievement of graduate learning that is charged to the course; 3) The final ability planned at each stage of learning to meet the learning outcomes of graduates; 4) Criteria, indicators and assessment weights; 5) Student learning experience that is manifested in the description of the tasks that must be done by students for one semester; 6) Learning methods; 7) Study material related to the ability to be achieved; 8) Time provided for achieving ability at each learning stage: 9) Reference list used; 10) Learning Scenarios.

The next step is to organize the CAM course material, based on the description above, the CAM course material is presented in the layout below: 1) Preface; 2) Table of Contents; 3) Chapter I Introduction; 4) Chapter II Mastercam X; 5) Chapter III Design; 6) Chapter IV Machining Process; 7) Chapter V Routine Tasks and Exercises; 8) Bibliography integrated with 6 student assignments.

Furthermore, validating the learning kit by the material expert, based on the expert assessment of the material, shows that the CAM Semester Learning Design and CAM Teaching Materials have met the criteria very suitable for the use of the CAM learning device, followed by validating the learning kit by the students participating in the lecture which shows that the teaching material CAM has met the criteria very suitable for use with CAM learning tools.

Furthermore, an individual trial was conducted on 3 college participants consisting of one high achiever, one moderate achiever, and one low achiever. The aim of this individual trial was to identify the shortcomings of the Semester Learning Design and CAM course material as a learning tool. Statistics on the results of individual trials of semester learning designs, the results indicate that it can be concluded that the CAM learning semester courses in good criteria with a total average of 3.13, but still needs improvement. Furthermore, the results of individual trials on CAM Subjects and based on the results of the assessment of learning participants on the CAM Subjects developed were concluded that the CAM Subjects in good criteria with a total average of 3.11, but still needs improvement.

After going through the improvement in the learning tool components of individual test results, then a small group trial is then conducted at the research site conducted on 12 participants in the 2017 semester consisting of four high-achieving college participants, four moderate-achievers, and four high achievers low. This small group trial data is intended to find out some of the weaknesses or difficulties faced by participants when learning tools are used in CAM lectures. The learning kit that was piloted in this small group was used as the initial product before the CAM course learning tool based on the Indonesian National Qualifications Framework was trialed to the field.

Based on the results of student assessment data of participants in the small group test on teaching materials that have been improved and developed above it can be concluded that the average results of the assessment of teaching materials 3.32 these results are included in the very appropriate criteria. Thus it can be used as teaching material for CAM course learning. Furthermore, based on the assessment of students participating in a small group test on the CAM Course Semester Learning Design developed it can be concluded that the average total CAM lesson design assessment semester is 3.35 being in very suitable criteria, thus it can be used as a CAM Study Semester Learning Design. From the results of the assessment of teaching materials with a total average of 3.32 and the average semester course design total of 3.35, both are in the very appropriate category, it can be concluded that the semester learning design and CAM course teaching materials can be used as CAM learning courses.

The effectiveness test of CAM subjects learning tools is carried out in odd semester of the D3 Mechanical Engineering study program. At the initial stage students are given a pretest which shows the number of students participating in the posttest (n) of 14 people, highest score of 56, lowest grade of 12 and average value 38.

Furthermore, the hardware and softcopy of CAM course learning tools consisting of Semester Learning

Design, CAM Subjects Textbook based on the Indonesian National Qualification Framework and Tasks and Exercises. In the learning kit all students have planned to do during the lecture. As the application of lectures based on the Indonesian National Qualification Framework at Medan State University which implements 6 tasks consisting of: 1) Routine Tasks; 2) Critical Book Review (CBR); 3) Idea Engineering Task (TRI); 4) Critical Journal Review; 5) Project; 6) Mini Research (MR), complete with writing and assessment guidelines.

The lectures are carried out according to the academic calendar of Medan State University where before the skills and cognitive tests are conducted, a questionnaire about the effectiveness of the CAM Learning Tools is given to students.

Summary data on the tendency of the effectiveness of CAM learning devices shows that of 15 students 66.66 percent (10 people) showed that CAM learning devices were very petrified, 33.33 percent (5 people) showed help and no one showed no help or very unhelpful. These results indicate that the CAM learning device has a significant effectiveness in learning CAM courses.

Further skills assessment was carried out and the results of the skills scores showed for 15 students to Milling the highest score of 95, the lowest score of 80 and an average of 86.13 while the Turning skill score, the highest score of 95, the lowest score of 75 and the average value of Turning skills 83.87. Furthermore the average total skill value is 85.

The last posttest was carried out and the posttest results showed the number of posttest participants (n) 15 people, the highest score was 92, the lowest score was 72 and the average value was 80.53. Pretest values indicate the highest value of 56, the lowest value of 12 and an average value of 38.0. T test results showed that the average posttest and pretest showed significant differences.

Data on the level of effectiveness of the 6 assignments on 15 students showed 33.33 percent (5 people) showed that the CAM learning device was very petrified, 66.66 percent (10 people) showed help and no one showed no help or very unhelpful. These results indicate that CAM learning tools for 6 assignments have significant effectiveness in learning CAM courses.

Furthermore, the tendency level of student attitude scores is presented in Figure 5.34, and attitude value data shows the number of students participating in attitude values of (n) 15 people, the highest value is 3.9, the lowest value is 2.6 and the average value is 3.16.

The data on the tendency of attitude values in table 5.33 shows that from 15 students 20.00 percent (3 people) showed that the attitude of CAM was very high, 80.0 percent (12 people) showed good grades and none showed bad or very bad.

Development of learning tools has been carried out in accordance with the steps of R&D, based on the results obtained indicate that the learning device has a significant effectiveness on increasing the CAM subject value.

Based on the assessment of material experts and students participating in the lecture shows that the CAM Course Semester Learning Design and CAM Teaching Materials have met the criteria very suitable for the use of the CAM learning equipment, then based on the assessment of college student participants that the CAM Study Semester Learning Design and CAM Teaching Materials have met the criteria in accordance to be used as a CAM learning device. The results of the calculation of the percentage increase showed that the posttest value increased significantly from the pretest value and based on the results of the t-test the average posttest and pretest showed a significant difference.

If the definition of effectiveness is derived from the root word: effective/ effective/ a, there is an effect (effect, effect, impression); 2 efficacious or efficacious (tt medicine); 3 can bring results; effective (tt effort, action); 4 comes into force (about laws, regulations); effectiveness of n 1 influential circumstances; memorable thing; 2 efficacy; efficacy (tt medicine); 3 success (tt effort, action); 4 things come into force (about laws, regulations). Further effectiveness/ effectiveness means: effectiveness. Depdiknas (2008) and the concept put forward by Drucker (1997) states that effectiveness is the foundation for achieving success. Then it was stated that the effectiveness with respect to the degree of achievement of objectives both explicitly and implicitly, namely how far the plan can be implemented and how far the goal is achieved, is associated again with the opinion of Ferda et al. (2018) effectiveness is a criterion for selecting various alternatives to be made recommendations based on a consideration of whether the recommended alternatives provide maximum results, regardless of efficiency considerations.

Also if associated with Wojosoto's definition the word effective means the occurrence of an effect or the desired effect in an action. The word effective means successful, precise, effective (Wojowisoto, 1980). So effectiveness is something that contains an understanding of the occurrence of a desired effect or effect. If someone performs an action with a specific purpose or has the intention as desired, then that person is said to be effective. Furthermore, effectiveness is the ability to choose the right destination or equipment to achieve the stated goals (Ferda et al., 2018).

From the various opinions above, it can be seen that effectiveness emphasizes more on aspects of goals and an organization, so if an organization has succeeded in achieving its stated goals, it can be said to have achieved

effectiveness. Thus the effectiveness is essentially oriented towards achieving predetermined goals.

Conclusion

Based on the assessment of material experts and students participating in the lecture shows that: Learning Design The CAM course semester meets the criteria very suitable for use in the CAM learning device; CAM teaching materials have met the criteria according to be used as a CAM learning device; Learning tools have a significant effectiveness on increasing the CAM Subjects Value.

Acknowledgments
Thank you to Medan State University which has assisted in fully financing this research through Medan State University PNBP funds in accordance with the Decree of the Head of LPPM UNIMED Number: 0152/UN33.8/PPKM/PD/2025.

Author Contributions
Conceptualization, E. Y., B. S., B. M. P.; methodology, E. Y and B. S.; validation, B. S.; formal analysis, B. M. P.; investigation, E. Y. and B. M. P.; resources, B. S. And B. M. P.; data curation, E. Y.; writing—original draft preparation, E. Y; writing—review and editing, B. S. and B. M. P.; visualization, E. Y. and B. S. All authors have read and agreed to the published version of the manuscript.

Funding
This research was funded by Medan State University PNBP In accordance with the Decree of the Chairman of LPPM UNIMED Number: 0152/UN33.8/PPKM/PD/2025.

Conflicts of Interest
The authors declare no conflict of interest.

References

Agustin, A., Suryono, H., & Yuliandari, E. (2017). Teknik Penilaian Diri Berbasis Google Form pada Mata Pelajaran Pendidikan Pancasila dan Kewarganegaraan. *PKn Progresif*, *12*(1), 483. Retrieved from https://shorturl.at/KUyvz

Aidin, L. (2019). Pengembangan Aplikasi Lembar Kerja Peserta Didik (LKPD) PJOK Berbasis Android Pada Sekolah Menengah Kejuruan. *Jurnal Mitra Pendidikan (JMP Online)*, *3*(2), 230–231. Retrieved from https://repository.unesa.ac.id/sysop/files/2020-12-23_Artikel Anung P Jurnas3.pdf

Anggreani, M. A. (2017). Kompetensi Guru Paud Di Kelurahan Balas Klumprik Dalam Mengembangkan Perangkat Pembelajaran. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan Unipa Surabaya*, *11*, 34. https://doi.org/10.36456/bp.vol13.no23.a448

Anindita, N. (2013). *Aplikasi Translator Messenger Berbasis Java Dan Google Translate API*. Yogyakarta State University.

Borg, W. R., & Gall., M. D. (1998). *Educational Research: An Introduction*. Pearson Education Inc. Boston.

Butcher, C., Davies, C., & Highton, M. (2006). *Designing Learning: From Module Outline to Effective Teaching*. Routledge. https://doi.org/10.4324/9780203968482

Depdiknas. (2008). *Kamus besar bahasa Indonesia.* Jakarta: Pusat Bahasa.

Dick, W., Carey, L., & Carey, J. (2009). *The systematic design of instruction* (7th ed.). USA: Pearson Higher Education Inc.

Drucker, P. F. (1997). *The Frontiers Of Management: Manajemen Lintas Peluang.* PT Elex Media Komputindo.

Ferda, M., Sarah, S., & Marlien, L. (2018). Efektivitas Kebijakan Restrukturisasi Organisasi Pemerintah Kecamatan Siau Barat Selatan Kabupaten Siau Tagulandang Biaro. *Jurusan Ilmu Pemerintahan*, *1*, 1–12. Retrieved from https://ejournal.unsrat.ac.id/index.php/jurnalek sekutif/article/view/19800

Gusmira, L., & Matondang, Z. (2017). Penerapan Model Pembelajaran Quantum Teaching Untuk Meningkatkan Aktivitas Dan Hasil Belajar Konstruksi Bangunan Siswa SMK Negeri 2 Medan. *Pelangi Pendidikan*, *23*(1), 50. https://doi.org/10.24114/pelangi.v23i1.6226

Iskandar, A., & Rizal, M. (2018). Analisis kualitas soal di perguruan tinggi berbasis aplikasi TAP. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *22*(1), 12–23. https://doi.org/10.21831/pep.v22i1.15609

Kemdikbud. (2025). *Roadmap Pengembangan TIK Direktorat Pembinaan SMA Tahun 2017 – 2025*. Jakarta: Kementerian Pendidikan dan Kebudayaan.

Mardapi, D. (2008). *Techniques for Preparing Test and Non-Test Instruments*. Yogyakarta: Mitra Cendikia Press.

Marliani, N. (2015). Peningkatan Kemampuan Berpikir Kreatif Matematis Siswa melalui Model Pembelajaran Missouri Mathematics Project (MMP). *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *5*(1), 21. https://doi.org/10.30998/formatif.v5i1.166

Nurhasanah, A. (2017). Pengembangan Bahan Ajar Pendidikan Matematika 1 Untuk Meningkatkan Kualitas Pembelajaran Mahasiswa Pgsd Universitas Kuningan. *Jurnal Pendidikan Dasar Kampus Cibiru*, *9*(2), 67. https://doi.org/10.17509/eh.v9i2.7017

Pannen, P. (1996). *Teaching in Higher Education, Book Four, Part "Development of Teaching Materials."* Jakarta: PAU-PPAI.

Permendiknas. (2008). *Menteri Pendidikan Nasional Republik Indonesia Tentang Buku (Nomor 2 Tahun 2008)*. Jakarta: Kemdikbud.

Pinahayu, E. A. R., Auliya, R. N., & Adnyani, L. P. W. (2018). Implementasi Aplikasi Wingeom untuk Pengembangan Bahan Ajar di SMP. *Jurnal PkM Pengabdian Kepada Masyarakat*, *1*(02), 112. https://doi.org/10.30998/jurnalpkm.v1i02.2544

Ristek-Dikti. (2015). The National Standard of Higher Education. In *Regulation of the Minister of Education and Culture of the Republic of Indonesia* (p. 58). Retrieved from https://ppmi.itltrisakti.ac.id/wp-content/uploads/2018/12/SNPT.pdf

Saputro, O. A., & Rahayu, T. S. (2020). Perbedaan Pengaruh Penerapan Model Pembelajaran Project Based Learning (Pjbl) Dan Problem Based Learning (Pbl) Berbantuan Media Monopoli. *Jurnal Ilmiah Pendidikan*, *4*(1), 185–193. Retrieved from https://ejournal.undiksha.ac.id/index.php/JIPP/article/view/24719%0Ahttps://ejournal.undiksha.ac.id/index.php/JIPP/article/download/24719/15020

Syah, M. (2007). *Psychology of Learning*. Jakarta: Rajawali Press.

Thiagarajan, S. (1974). *Instructional Development for Training Teachers of Exceptional Children: A Sourcebook*. Bloomington: Indiana University.

Wojowisoto, S. (1980). *Public Service Management*. Jakarta: Gramedia.

Yaumi, M. (2016). *Principles of Instructional Design*. Jakarta: Kencana Prenada Media Group.